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ABSTRACT

This teacher's guide is designed to provide elementary teachers with an assortment of classroom activities dealing with the Mt. St. Helens eruption of May 18, 1980, in the areas of science, social studies, math, language arts, and school newspaper activities. Copy masters and teacher versions of all activities are contained with this guide, including: (1) objectives; (2) teaching suggestions; (3) answers; (4) special directions for the procedures in the activities. These activities are designed to be used in three ways: (1) as sources for the construction of interdisciplinary units based on Mt. St. Helens; (2) as supportive materials in science curriculum; and (3) as individual activities to be used as part of existing classroom units. (CS)

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SE 035 547

MOUNT ST. HELENS CLASSROOM ACTIVITIES: ELEMENTARY

MOUNT ST. HELENS CURRICULUM MATERIALS PROJECT
EDUCATIONAL SERVICE DISTRICT 112
Project director: John Pope
August 22, 1980

DEVELOPMENT PAID FOR BY:
Cowlitz Teacher Center
The Daily News, Longview, Wash.
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*Miles from Mount St. Helens

The project director wishes to thank Roger L. Calhoun, principal of Toutle Elementary School, who originated the idea for the Mount St. Helens Curriculum Materials Project.

And special thanks go to Joan LeMieux, director of the Cowlitz Teacher Center. Joan was very instrumental in planning, financing, and developmental phases of this project. Without her assistance and advice, these materials could not have been developed as successfully as they have.

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SUBJECTS
*SCI (Science)
LA (Language Arts)
SS (Social Studies)

LEVEL(s)
**P (Primary)
I (Intermediate)
MS (Middle School)
HS (High School)

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FRONT COVER: Mount St. Helens erupts on July 22, 1980.
ALICE JACKSON/Columbian

BACK COVER: Spirit Lake lies devastated following May 18, 1980 eruption.
CHERYL HASELHORST/Columbian

INTRODUCTION

The goal of the Mount St. Helens Curriculum Materials Project is to provide teachers with classroom activities relating to the May 18, 1980, eruption. The project materials were developed between July 15 and August 19, 1980. This clearly is a dramatically short time line for a curriculum development project.

The intent has never been to present a comprehensive text on volcanism, nor has it been to prepare an introduction to geology. Rather, it is to provide high quality activities in several subject areas from which teachers can make selections for their classroom use.

We hope teachers will find these materials useful as a source of supplementary activities in the classroom. We encourage teachers to experiment with alternative ways of using the materials.

THE FORMAT:

The material is in three parts: a student tabloid containing news articles, and teacher guides at the elementary and secondary level containing activities. This unique format allows for maximum flexibility in using the 52-page student tabloid, "Mount St. Helens," and the elementary and secondary teacher's guides as a set of resources with multiple-use potential.

The 52-page student tabloid, **Mount St. Helens,** contains news articles, feature stories, editorials, diagrams and photographs dealing with the mountain and related events. The content focuses on the May 18 eruption, but other eruptions and effects are included.

The tabloid is divided into four sections.

The **Background** section offers activities dealing with volcanoes in general, the history of the mountain and other related information. The **Precursors** section deals with earthquakes, harmonic tremors, fumaroles and other events leading to the eruption. The **Eruption** section describes the May 18 eruption and immediate effects, including mudflows and ash fall. The **Effects** section of the tabloid deals with events and people such as Harry Truman, commercialization, industrial damage, medical effects and other social factors.

The two teacher's guides, **Mount St. Helens: Classroom Activities**, are designed to provide elementary and secondary teachers at all grade levels with an assortment of quality activities in the areas of science, social studies, math, language arts and newspaper in the schools. The guides contain copy masters as well as teacher versions of all activities. **IT IS RECOMMENDED TEACHERS PHOTOCOPY OR THERMOFAX ALL STUDENT ACTIVITY PAGES.**. The teacher version of each activity contains objectives, teaching suggestions, answers and special directions for the procedures in the activities.

The copy masters are keyed by reference articles to the student tabloid and can be used to make photocopies, transparencies and/or ditto masters of the activity for students. Each of the five sections includes an overview of activities stating grade level and subject area. Both guides contain a summary overview before each section to aid the teacher in selecting activities.

USE OF THE MATERIAL:

These materials are designed to be used primarily in three ways. Interdisciplinary units based on Mount St. Helens can be built from several activities. A subject such as science can be supported by selected activities. Individual activities can be used as a part of existing classroom units. Teachers are encouraged to use the materials in any other way they choose.

An interdisciplinary unit involving language arts, science, social studies and math could be taught focusing on Mount St. Helens, for example. The teacher can select activities at the right level in each subject area. These activities when presented together will represent a well-balanced, educational unit. This approach will give the students a chance to experience the event from all perspectives; to know that mudflows not only raised the river's temperature and turbidity, but also destroyed homes, property and a way of life for many people. They will also discover that the eruption not only resulted in emergency shipment of filter masks, but also led to eventual changes in some people's behavior, long after ash was cleaned up.

Another possiblity is to use the activities as the basis for teaching a Mount St. Helens unit in a specific subject area such as language arts, science or social studies. In a social studies unit, students can investigate the effects of the eruption of Mount St. Helens on the lives, jobs and homes of people along the Cowlitz River. Another unit can be built to explore how newspapers are used to keep the public informed.

An individual activity can be used to support a unit. In an environmental science unit, for instance, activities that examine dissolved oxygen and total suspended solids will be very supportive. A Mount St. Helens poetry activity would be a timely part of a poetry unit.

The Language Arts: Newspaper In The Schools section contains language arts activities, several of which focus on specific parts of the newspaper. These activities can be used to teach basic language arts concepts with Mount St. Helens as the topic. Several activities are designed specifically to be used to teach the newspaper in the schools concept. In addition, some of the activities in this section can be used in other subject areas.

Teachers may use all of a given activity or just those parts most applicable. Some of the more challenging or demanding questions have been identified as extension questions or activities. These could be used as enrichment for more able students as individual projects, or as special class projects.

CAUTION: Items listed as teacher demonstrations are just that! Teacher demonstrations are dangerous and no students, under any circumstances, should be allowed to do these demonstrations. Teachers should attempt these demonstrations with the greatest of caution and only after careful preparation.

VALIDATION AND REVISION:

Due to the need to provide these materials to teachers as quickly as possible, they are being published before field testing and validation. The materials will be field tested during their first year of distribution. Revision based on field testing tentatively are scheduled for the summer of 1981.

INFORMAL INPUT:

We are very interested in your reaction to these materials. Your suggestions for additional activities are welcome.

Please feel free to contact the project director at the address listed below:

John Pope, project director
Mount St. Helens Curriculum Materials Project
Educational Service District 112
1313 N.E. 134th St.
Vancouver, Wash. 98665

LEVEL INFORMATION: SCI I

ACTIVITY I — TYPES OF VOLCANOES

OBJECTIVE:

The student will be able to distinguish the three major types of volcanoes.

TEACHING SUGGESTIONS:

1. Ask students to read the reference articles.
2. Discuss with the class the difference between the three types of volcanoes.
3. Do Activity I, "Three Types of Volcanoes" as a whole class activity.

REFERENCE:

Volcanoes: Where and Why? Crustal Evolution Education
Project, Ward's Natural Science Establishment, Inc.
Rochester, N.Y.

ACTIVITY I — DEMONSTRATE THE THREE TYPES OF VOLCANOES BY BUILDING THREE MODELS

REFERENCE ARTICLES:

— "Three major types of volcanoes," Page 2
— "Scientists watch dome for signs of lava flow," Page 34
— "Dome might signal possibility of new blast," Page 35

MATERIALS:

Bucket
Sand, fine soil (for mud)
Sheet of plastic to protect floor
Water
Funnel
3 shallow boxes at least 15 inches square and 2 inches deep
Plaster or Fix-All

PROCEDURE:

1. Line each of three shallow boxes or box lids with plastic.

Model A. Cinder cone model:

Pour sand through a funnel and let it collect in a symmetrical pile in the box. Do this several times and note the shapes of the piles.

Model B. Shield Model:

Mix a bucket of mud to the consistency of thick gravy and pour it on a sheet of plastic in the box. It will help if some plaster or Fix-All is added to improve the consistency and give the lava a distinctive color. Let it stand until it firms up, then pour another layer over the first. The formation will be more visible if a few drops of vegetable coloring are added to each "layer." By carefully placing each pour, a shield formation should develop.

It will help the demonstration if the box has a layer of sand in it to absorb excess water.

Model C. Composite Model:

1. Pour out a small pile of sand. Then pour mud mixture containing plaster or Fix-All over it. When mud sets, pour more sand and then mud. Repeat until cone is built up.
2. Reread the "Three Types of Volcanoes," Page 2 of "Mount St. Helens."
3. Discuss the questions.

QUESTIONS:

Model A represents a cinder cone:

1. Why does the sand form a cone-shaped pile?

Material comes from a single point source (in this case the funnel) in a volcano, the crater. It falls down the sides until it comes to rest.

2. How steep were the slopes of the "cinder cone" and what differences did you note? (Use a protractor)

The angles were 30-35 degrees. The angle was the same whether the piles of sand were large or small.

3. What do you think determines the angle?

The particles roll down the slope because of gravity. The angle is constant and relates to the ''resting'' position. For steeper angles, the grains would roll down. For less steep angles, it would not roll and remain where it lands. This causes the angle to be constant for particles of a certain shape. (Angular blocks can form somewhat steeper slopes and spherical ones.)

4. How is the model similar or different from a real cinder cone?

It has a similar shape. Its origin is different, and the model has no crater. The sand came from above, while cinders come from underground.

Model B represents a shield volcano:

5. How does a shield volcano form?

One layer is added on top of another layer.

6. Why does a shield volcano form a more gentle slope than that of a cinder cone?

Lava (mud) runs down the mountain and does not pile up.

Model C represents a composite volcano:

7. What allows the composite volcano model to build a steeper cone than the shield volcano?

As the cinders (sand) keep building a cone over the layers of lava (mud) the cone shape is kept. Actual volcanoes will vary, depending upon the ratio of cinder to lava eruptions.

8. What type of volcano is Mount St. Helens? (Review the reading material and the diagrams in "Mount St. Helens".) Explain your answer.

Mount St. Helens is a composite volcano. It consists of layers of cinders and lava.

ACTIVITY II — TYPES OF LAVA

The chart below shows the types of volcanic lava. A different amount of silica is found in each type of rock. The more silica present in the rock, the thicker the magma becomes.

Basalt	Less than 52% silica
Andesite	54-66% silica
Dacite	63-66% silica
Rhyolite	More than 66% silica

QUESTIONS:

1. Which lava is the runniest?

Basalt

2. Which lava is the thickest?

Rhyolite

3. Read the articles "Scientists watch dome for lava flow", Page 34, and "Idle dome might signal possibility of new blast," Page 35. What two types of rock would be most likely to form a "plug?" Why?

(A) Rhyolite and (B) dacite. Because these two lavas are so thick, they are less likely to move quickly. Thus, they cool and become hard when they reach the top of the crater.

4. Most of the recent eruptions of Mount St. Helens have been of andesite and dacite. However, in the past there were some basalt eruptions. How do you think these two kinds of eruptions differed?

Basalts are the thinnest rock, so probably lava flowed over the side as a classic flow. Probably less pyroclastic material was released because the rock was thinner, more dense. Also, less ash would be emitted because less pressure would be needed.

EXTENDED ACTIVITY

Make a booklet showing the stages in the building of any of the three volcano types.

NAME:____ DATE:________________

ACTIVITY I — DEMONSTRATE THE THREE TYPES OF VOLCANOES BY BUILDING THREE MODELS

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It will help the demonstration if the box has a layer of sand in it to absorb excess water.

Model C. Composite Model:

1. Pour out a small pile of sand. Then pour mud mixture containing plaster or Fix-All over it. When mud sets, pour more sand and then mud. Repeat until cone is built up.
2. Reread the "Three Types of Volcanoes," Page 2 of the student tabloid.
3. Discuss the questions.

QUESTIONS:

Model A represents a cinder cone:

1. Why does the sand form a cone-shaped pile?

2. How steep were the slopes of the "cinder cone" and what differences did you note? (Use a protractor)

3. What do you think determines the angle?

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4. How is the model similar or different from a real cinder cone?

Model B represents a shield volcano:

5. How does a shield volcano form?

6. Why does a shield volcano form a more gentle slope than that of a cinder cone?

Model C represents a composite volcano:

7. What allows the composite volcano model to build a steeper cone than the shield volcano?

8. What type of volcano is Mount St. Helens? (Review the reading material and the diagrams in "Mount St. Helens".) Explain your answer.

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NAME: ______________________________ DATE: ______________

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4. Most of the recent eruptions of Mount St. Helens have been of andesite and dacite. However, in the past there were some basalt eruptions. How do you think these two kinds of eruptions differed?

NAME: ______________________________ DATE: ______________

EXTENDED ACTIVITY

Make a booklet showing the stages in the building of any of the three volcano types.

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LEVEL INFORMATION: SCI/SS P/I

VOLCANO BACKGROUND — TIME LINE

OBJECTIVE:
The students will make a timeline of the activity of Mount St. Helens over the years and compare it to three other time lines.

TEACHER BACKGROUND:
The students will be reading articles on the history of volcanoes and Mount St. Helens. Mount St. Helens' history goes back about 37,500 years, and scientists have been able to plot its eruptive history for about the past 8,000 years.

TEACHING SUGGESTIONS:
1. In "Mount St. Helens" and in Appendix V, you will find the history of Mount St. Helens. The students will make four time lines. Each student will compare the four suggested time lines and should notice that he or she has only been around a very short time.
2. For extended use, you may want to compare the time lines with a geological time line of the earth.

TIME TABLE FOR MOUNT ST. HELENS

REFERENCE ARTICLES:
— "Violent past for St. Helens," Page 50
— "Mount St. Helens has erupted many times," Page 3
— "Eruptions in past have killed many," Page 36
— Appendix V — Gifford Pinchot National Forest fact sheet, July 10, 1980.

MATERIALS:
Ruler
Pencil

PROCEDURE:
1. Read the reference articles, keeping in mind other important events in our history.
2. Tape together sheets 1 and 2. Be sure B.C. is to the left on the time line. Record the eruptions of Mount St. Helens on the time line. Use sheets and make a time line of important events in your life. Start with when you were born, your first step, your first word, when you started school, rode your bicycle the first time, or any other important event you can think of.
3. On the same chart, make a time line of the history of North America. Use a different color. Include the following dates:
- Hopewell Indian Culture — 300 B.C.
- Mississippian Tribal Culture — 600 A.D.
- Great Pueblo Period — 1000 A.D.
- Viking Exploration — 1000 A.D.
- Columbus Discovery — 1492 A.D.
- Jamestown Settlers — 1620 A.D.
- Signing of the Declaration of Independence — 1776 A.D.
- The Civil War — 1861 A.D.
- World War I and II — 1919 and 1941 A.D.
- Alaska's Statehood — 1959 A.D.
- Man on the Moon — 1970 A.D.

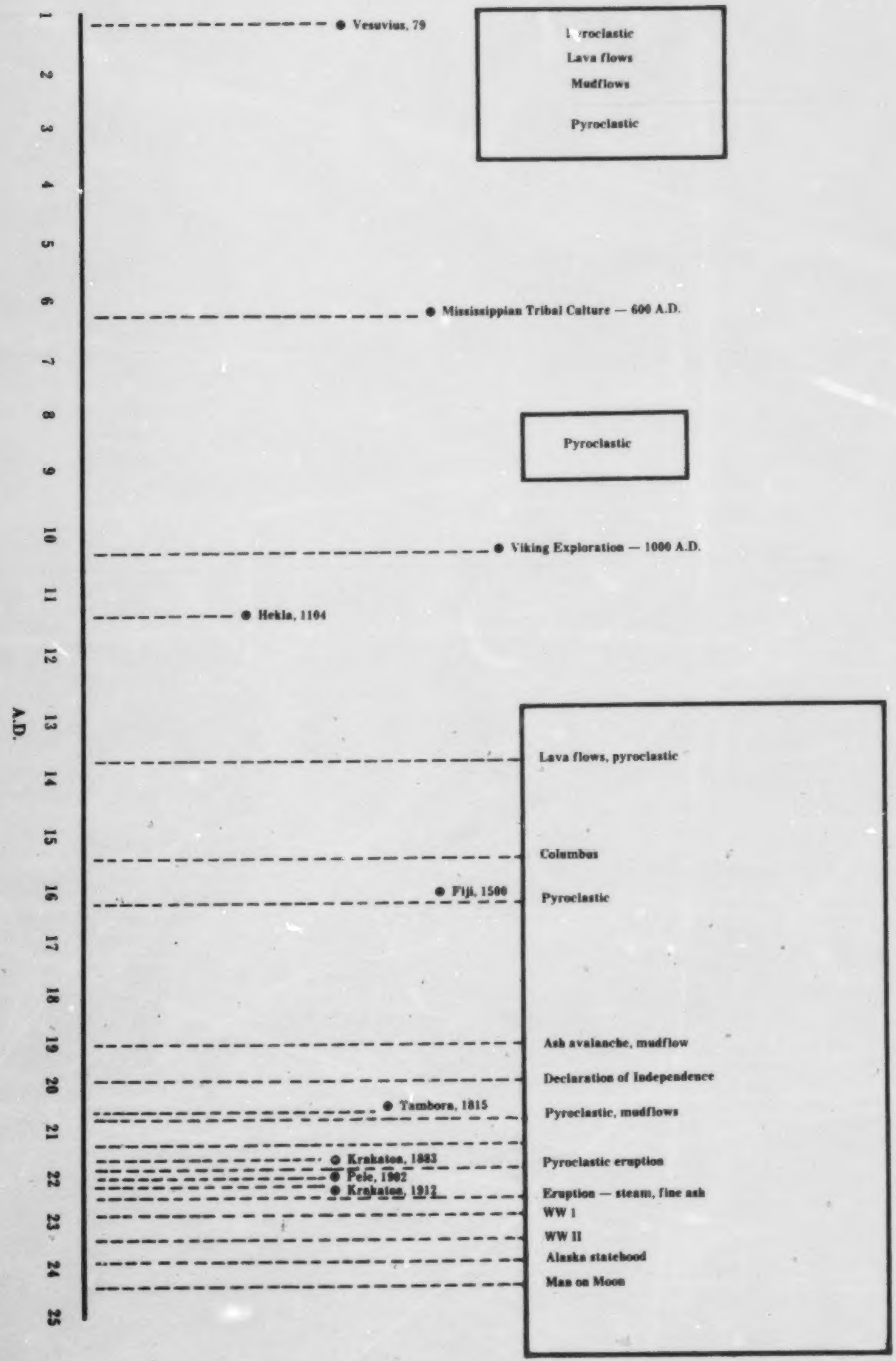
(Check an almanac for other significant dates.)
4. Still on the same time line, in a third color, record the historic eruptions of other volcanoes.

QUESTIONS:
1. What are two things you notice when you compare volcanic eruption time lines with other kinds of time lines?

Volcanic eruptions have been a part of the earth forming process for much of recorded history and are likely to remain a changing force. "Volcano history" has been going on much longer than recorded "people history."

2. Do you know of any volcanic eruption that may have changed the course of history?

Pompeii and Atlantis

A.D.
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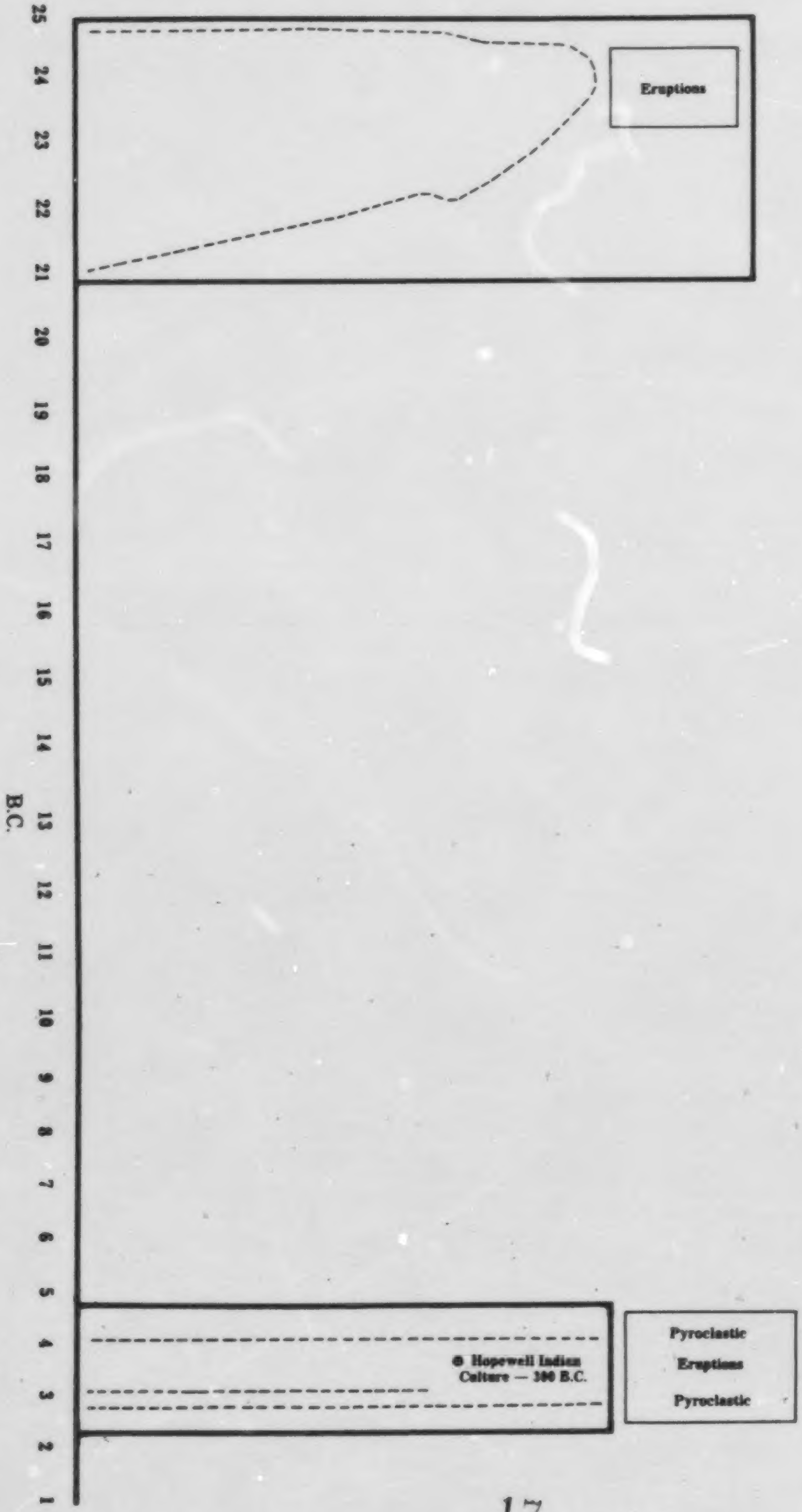
Krakatoa, 1912
Eruption — steam, fine ash
WW 1
WW II
Alaska statehood
Man on Moon

25
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NAME: ______________________________ DATE: ______________

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   - Jamestown Settlers — 1620 A.D.
   - Signing of the Declaration of Independence — 1776 A.D.
   - The Civil War — 1861 A.D.
   - World War I and II — 1919 and 1941 A.D.
   - Alaska's Statehood — 1959 A.D.
   - Man on the Moon — 1970 A.D.

   (Check an almanac for other significant dates.)

4. Still on the same time line, in a third color, record the historic eruptions of other volcanoes.

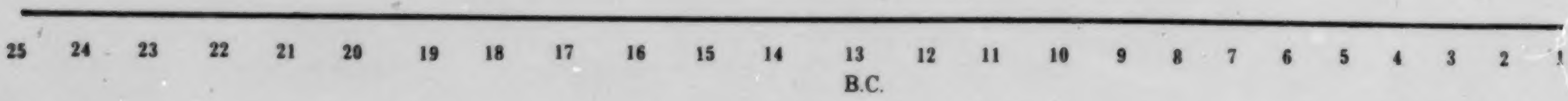
QUESTIONS:

1. What are two things you notice when you compare volcanic eruption time lines with other kinds of time lines?

2. Do you know of any volcanic eruption that may have changed the course of history?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

A.D.


B.C.

LEVEL INFORMATION: SCI/SS I

BUILDING MOUNT ST. HELENS FROM A TOPOGRAPHIC MAP

OBJECTIVES:
The student will:
1. **Build a scale model of Mount St. Helens before the May 18 eruption from clay.**
2. **Demonstrate the ability to read a simple topographic map.**

TEACHING SUGGESTIONS:
1. **Divide the class into three or four teams. Rather than have each student build a mountain, have each team do so.**
2. **Demonstrate molding clay on the template before students start.**
3. **Explain to the students that there is a 2:1 vertical exaggeration in the final product.**

BUILDING MOUNT ST. HELENS FROM A TOPOGRAPHIC MAP

REFERENCE ARTICLES:
— Photos on Pages 3, 5, 6 and 50

MATERIALS:
— U.S. Geologic Survey Mount St. Helens Topographic Quadrangle Map.
— Templates of the 4,000-, 5,000-, 6,000-, 7,000-, 8,000- and 9,000-foot levels of Mount St. Helens.
— Play dough, clay or flour and salt clay.
— Toothpicks and tape (optional).

BACKGROUND:

A topographic map is a series of lines drawn at a specific altitude. On the USGS map with this activity, those lines connect points of equal altitude. The numbers on the lines are the altitude in feet. The mountain you construct will approximate the shape of Mount St. Helens before the May 18 eruption.

PROCEDURE:
1. Place template 1 (4,000-foot level) on a flat surface.
2. Mold a piece of clay to fit within the lines. Be sure the clay remains at least 1 cm thick and stays within the lines.
3. Repeat this activity on templates 2 through 6.
4. Using drawing 7 for reference, place each of the pieces of clay on top of one another (2 on top of 1, 3 on top of 2, 4 on top of 3, 5 on top of 4 and 6 on top of 5).
5. Mold the clay to the general shape of Mount St. Helens. You now have a scale model of Mount St. Helens.

QUESTIONS:

1. Look at the USGS topographic map included with this activity. What is the altitude at the highest point on Mount St. Helens on May 17, 1980?

9,677 feet

2. What landmark is at approximatley 9,200 feet?

False summit

3. What is the altitude at Windy Pass?

4,800 feet

4. What is the altitude at Timberline Campground?

4,400 feet.

5. What is the altitude at June Lake?

3,200 feet.

EXTENDED ACTIVITIES

Using toothpicks, tape and the map, put labels on the location of each of the major landmarks on Mount St. Helens.

NAME: ______________________________ DATE: ______________

BUILDING MOUNT ST. HELENS FROM A TOPOGRAPHIC MAP

REFERENCE ARTICLES:
- Photos on Pages 3, 5, 6 and 50

MATERIALS:
- U.S. Geologic Survey Mount St. Helens Topographic Quadrangle Map.
- Templates of the 4,000-, 5,000-, 6,000-, 7,000-, 8,000- and 9,000-foot levels of Mount St. Helens.
- Play dough, clay or flour and salt clay.
- Toothpicks and tape (optional).

BACKGROUND:

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2. Mold a piece of clay to fit within the lines. Be sure the clay remains at least 1 cm thick and stays within the lines.
3. Repeat this activity on templates 2 through 6.
4. Using drawing 7 for reference, place each of the pieces of clay on top of one another (2 on top of 1, 3 on top of 2, 4 on top of 3, 5 on top of 4 and 6 on top of 5).
5. Mold the clay to the general shape of Mount St. Helens. You now have a scale model of Mount St. Helens.

QUESTIONS:

1. Look at the USGS topographic map included with this activity. What is the altitude at the highest point on Mount St. Helens on May 17, 1980?

2. What landmark is at approximately 9,200 feet?

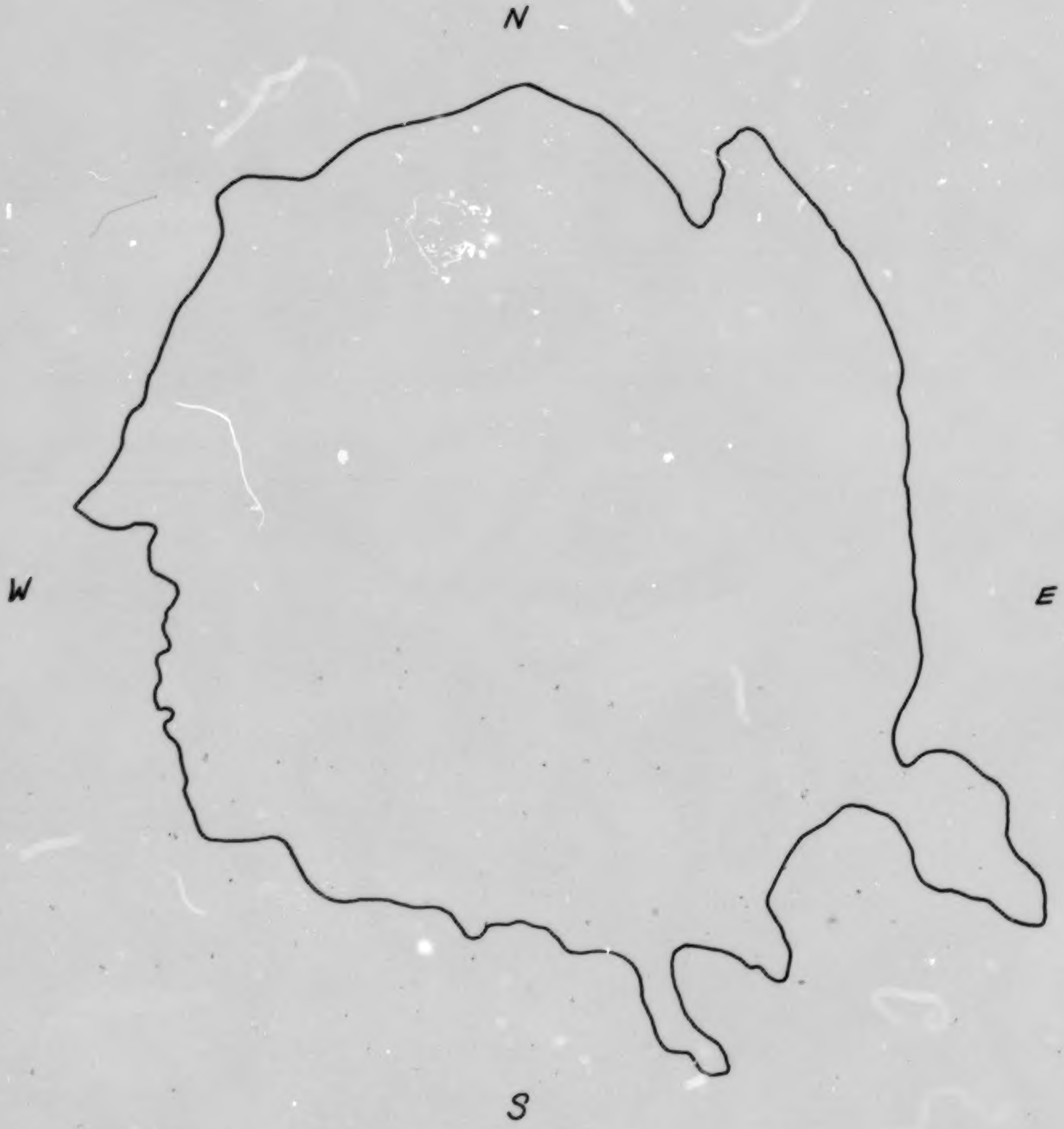
3. What is the altitude at Windy Pass?

4. What is the altitude at Timberline Campground?

5. What is the altitude at June Lake?

EXTENDED ACTIVITIES

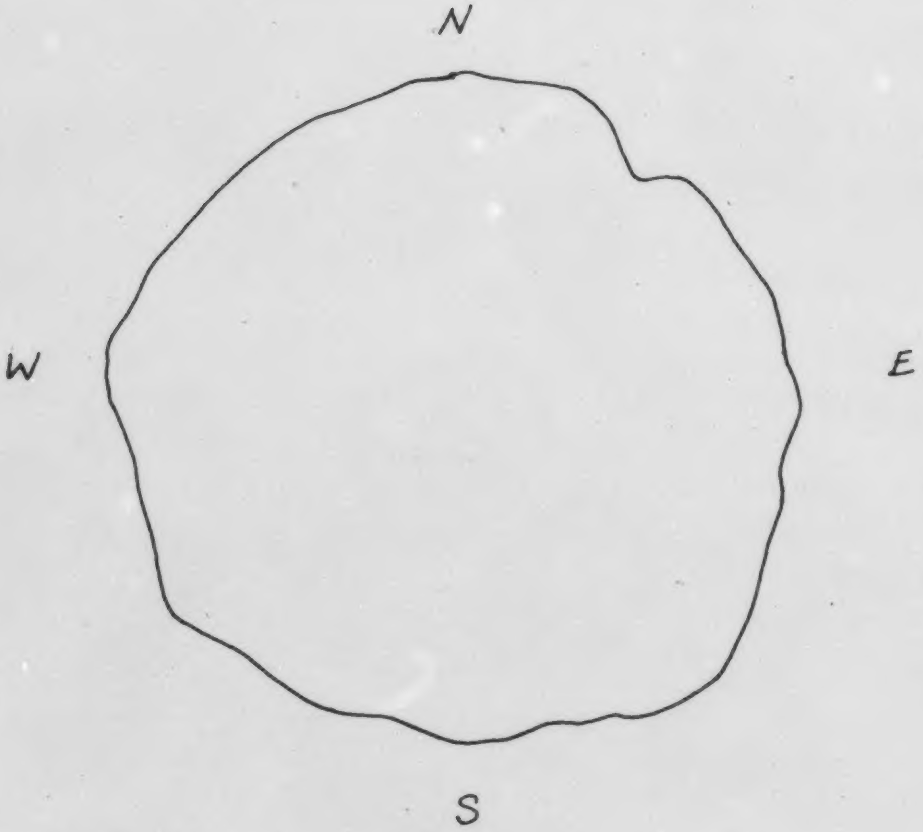
Using toothpicks, tape and the map, put labels on the location of each of the major landmarks on Mount St. Helens.



4,000 ft Level
Make clay 1cm. thick

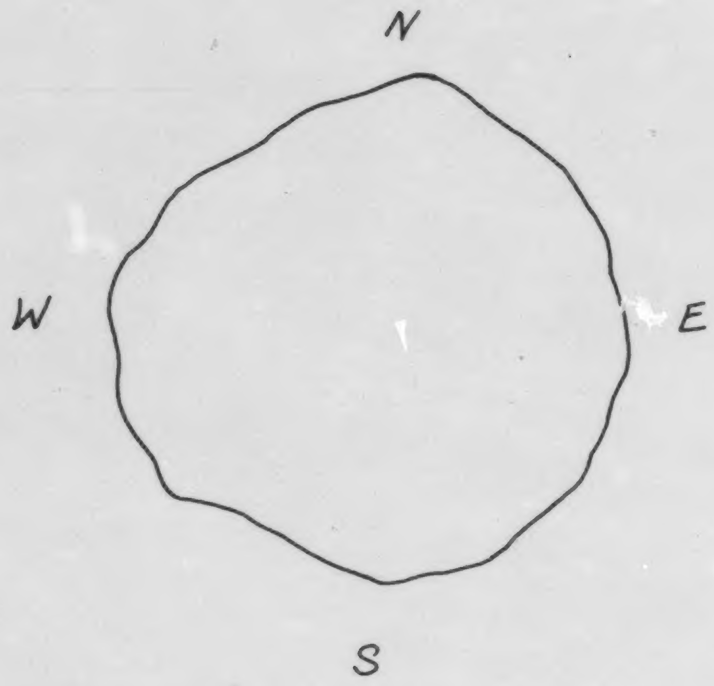
26

Template 1



5,000 ft. Level
Make clay 1cm. thick.

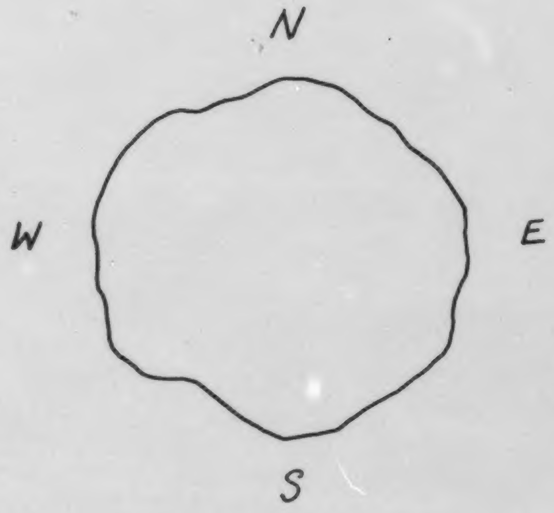
Template 2



6,000 ft. Level
Make clay 1cm. thick.

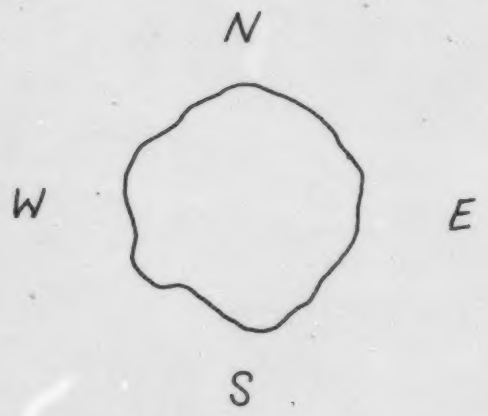
Template 3

28



Template 4

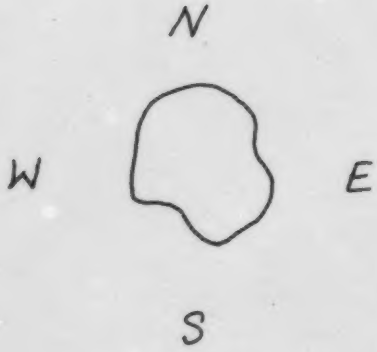
7,000 ft. Level
Make clay 1cm. thick.



30

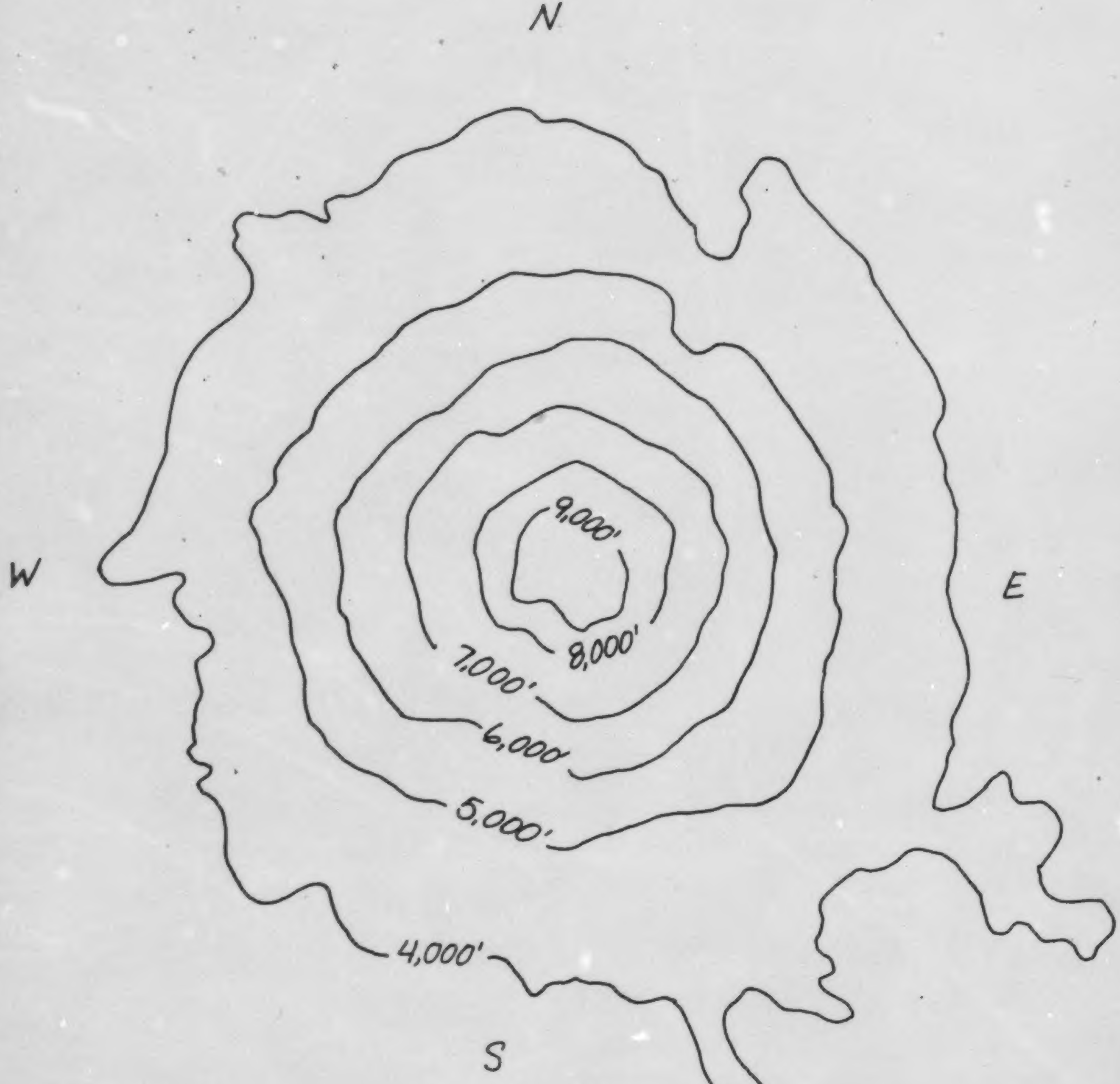
Template 5

8,000 ft. Level
Make clay 1 cm. thick.

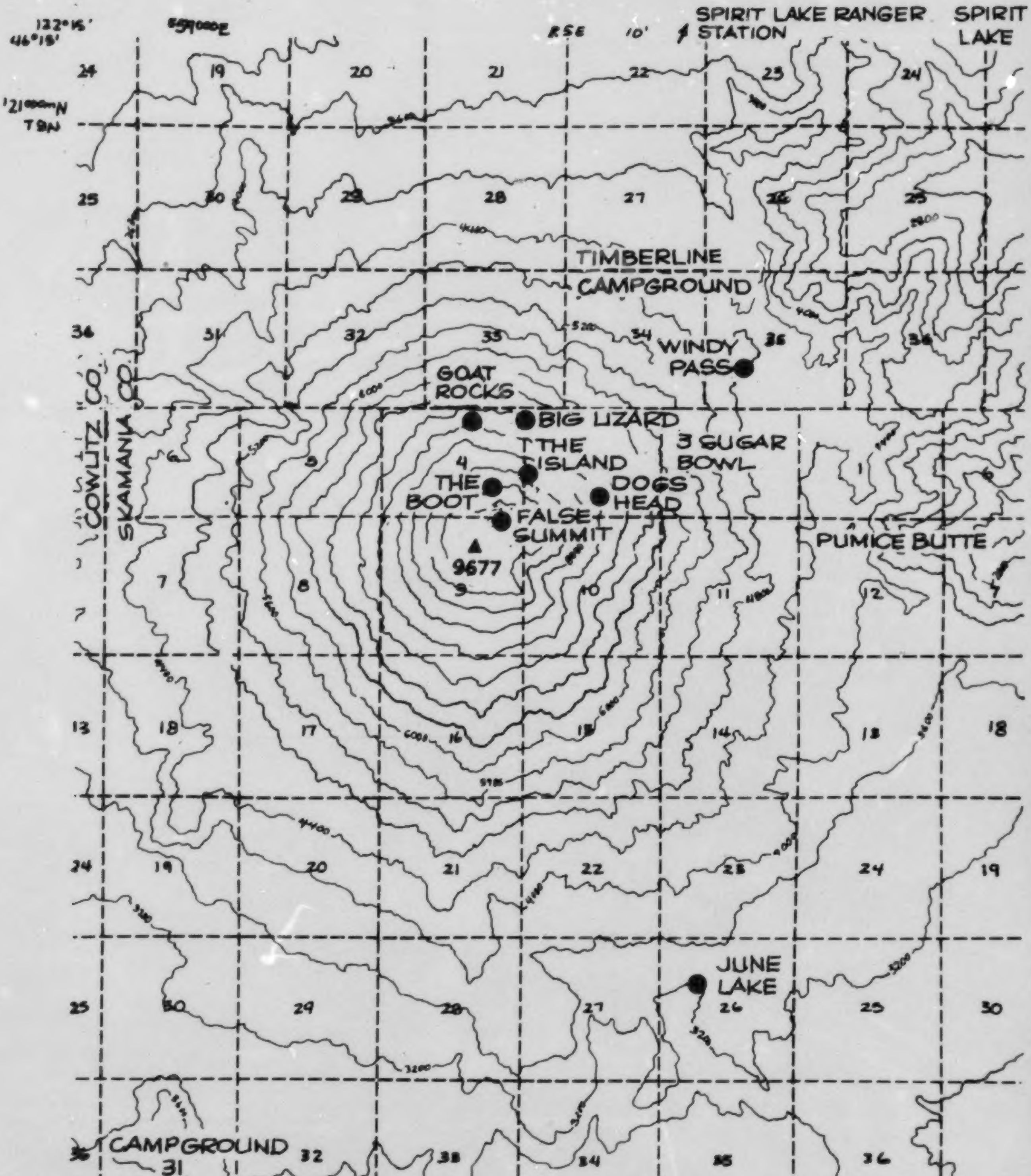


Template 6

9,000 ft. Level
Make clay 1 cm. thick.


N
W
9,000'
8,000'
7,000'
6,000'
5,000'
4,000'
E
S

Mount St. Helens
Drawing #7


122°15'
46°15'
559000E
R5E
10'
SPIRIT LAKE RANGER STATION
SPIRIT LAKE
121000mN
T8N
TIMBERLINE CAMPGROUND
WINDY PASS
GOAT ROCKS
BIG LIZARD
THE ISLAND
3 SUGAR BOWL
THE BOOT
DOGS HEAD
FALSE SUMMIT
PUMICE BUTTE
9677
COWLITZ CO.
SKAMANIA CO.
JUNE LAKE
CAMPGROUND 31
(COUGAR)
4400
5200
6000
3200
2800
2400

USGS MAP

LEVEL INFORMATION: SS P/I

MYTHS

OBJECTIVES:

The students will: 1. Discuss why people long ago created stories about natural phenomena.
2. Write a myth.
3. Illustrate their own and/or Indian myth.

TEACHING SUGGESTIONS:

1. **Tell the students to read the reference articles.**
2. **Discuss why people long ago created stories about volcanoes and earthquakes.**
3. **Discuss why the Indians were the first to create myths about Mount St. Helens, Mount Adams and Mount Hood.**
4. **Discuss how earthquakes and volcanoes are alike.**
5. **If possible, have someone from the local historical society visit the class, bringing in artifacts relating to local legends and myths.**

MYTHS

REFERENCE ARTICLES:

— "Cowlitz Indians say St. Helens is angry," Page 4.
— "1847 blasts kept Indians from peak," Page 4
— "Mountain 'disturbed too often,'' Page 5
— "Bottle of gin to be tossed in pit," Page 5

PROCEDURE:

1. Read the reference articles. Write the two names given Mount St. Helens and the tribe associated with the name below.

Si Yett (Yakima Indians) and Lavelatla (Cowlitz Indians)

2. Read the following description of other myths and legends:

Long ago, people did not know or understand what caused volcanoes and earthquakes. Many people were frightened by the mysterious rumblings inside the earth and the flows of lava. They explained these things through myths.

For instance, before Magellan sailed around the world, some people believed that the earth was flat and held up by two elephants standing on a turtle's back. When the earth shook, it was thought that the elephants were moving.

Other people thought that giant whales, slapping their tails against the ocean floor, caused the earth to tremble. Or, some thought, perhaps sea monsters were fighting.

Ancient Romans believed that Vulcan, (Latin Volcanus, Vulcanus), the god of fire and metal working, had a blacksmith shop under certain mountains. They believed that his main shop was under a mountain on an island near Sicily. The island is known as Vulcano. Its name became our word "volcano."

3. Not knowing can be frightening, like hearing noises in the dark or watching lightening streaks in the sky. What are some things that happen that you can't explain?

Answers vary

4. What three things were used to explain earthquakes?

(1) Elephants moving on turtle's back; (2) giant whales slapping tails on ocean floor; and (3) sea monsters fighting.

5. Read the stories below about Mount St. Helens.

Indians of the Pacific Northwest watched eruptions of Mount St. Helens long before the white man came. Early accounts of eruptions were handed down and accounted for in Indian legends. Here are some of the more popular versions.

From Puyallup Indians

A long time ago a huge landslide of rocks roared into the Columbia River near Cascade Locks and eventually formed a natural bridge. The bridge came to be called Tamanawas Bridge, or Bridge of the Gods. In the center of the arch the only fire in the world burned, so of course it was sacred to the Indians. They came from north, south, west and east to get embers for their own fires from the sacred fire.

A wrinkled old woman, Loowitlatkla ("Lady of Fire"), lived in the center of the arch, tending the fire. Loowit, as she was called, was so faithful in her task and so kind to the Indians who came for fire that she was noticed by the great chief Tyee Sahale. He had a gift he had given to very few others — among them his sons Klickitat and Wyeast — and he decided to offer this gift to Loowit. The gift he bestowed on Loowit was that she would have eternal life. But Loowit wept because she did not want to live forever as an old woman.

Sahale could not take back the gift, but he told Loowit he could grant her one wish. Her wish, to be young and beautiful, was granted, and the fame of her wondrous beauty spread far and wide.

One day Wyeast came from the land of the Multnomahs to see her. Just as he arrived at Tamanawas Bridge (a natural stone bridge that, according to Indian lore, once spanned the Columbia River), Klickitat came thundering down from the north. Both brothers fell in love with Loowit, but she could not choose between them. Klickitat and Wyeast had a tremendous fight. They burned villages. Whole forests disappeared in flames.

Sahale watched all of this fury and became very angry. He frowned. He struck Tamanawas Bridge, and it fell into the river where it boils in angry protest. He smote the three lovers, too, but even as he punished them he loved them. So where each lover fell he raised up a mighty mountain. Because Loowit was beautiful the mountain (St. Helens) is a symmetrical cone, dazzling white. Wyeast (Mount Hood) lifts his head in pride. Klickitat (Mount Adams), for all his rough ways, had a tender heart. He bends his head in sorrow as he weeps to see the beautiful maiden wrapped in snow.

From Yakima Indians:

Si Yett ("woman") is the Yakima Indian name for Mount St. Helens. According to legend, Si Yett was a beautiful white maiden placed on earth by the Great Spirit to protect the Bridge of the Gods on the Columbia River from the battling Mount Adams and Mount Hood.

From Klickitat Indians

Klickitat Indians tell of two braves, Pahto (Mount Adams) and Wyeast (Mount Hood), who fought to win affections of an ugly hag who'd been turned into a beautiful maiden by the Great Spirit.

From Cowlitz Indians

Cowlitz Indian legends tell of a time when Mount Rainier had an argument with his two wives, Mount St. Helens and Mount Adams. Mount St. Helens became jealous, blew her top and knocked the head off Mount Rainier.

Cowlitz Indians called Mount St. Helens "Lavelatla," which means "smoking mountain."

6. Why did the Indians make up myths about Mount St. Helens?

They didn't have a scientific explanation and needed to explain things they observed.

7. How are all the Indian identities of Mount St. Helens the same?

Mount St. Helens was always a person, not an animal.

8. Sometimes the mountain was female, sometimes male, but always there was a reason for the mountain to erupt. This reason was the basis for its identity. Select another identity for Mount St. Helens, either animal or human. List below some of the words associated with its identity before and during eruption.

Before eruption:

During eruption:

Answers vary. (If the students are not accustomed to this technique, "brainstorm" one example on the board as an illustration.)

9. In eight steps list what happens to your identity for Mount St. Helens from before the eruption, to the eruption, to following the eruption. Include any extra characters needed (for example, Mount Hood or the Columbia River.

1.

2.

3.

4.

Answers vary

5.

6.

7.

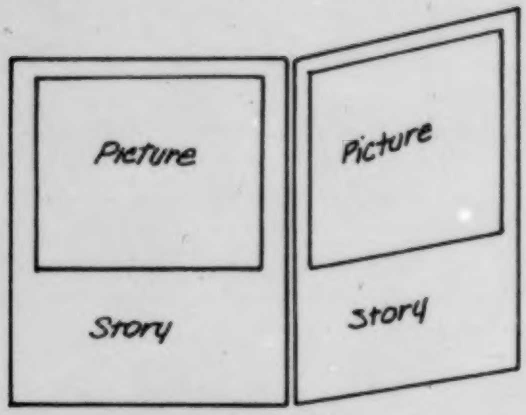
8.

10. Write your story about Mount St. Helens. Be sure to include necessary words from the list you have just made in Question 8.

11. Repeat Steps 8-10, only find a new identity for another natural phenomenon, for example, hurricane.

This could be done as an alternate activity to the one described in 8-10, if desired.

12. Select one of your myths and write a book for younger students. Each page should be mostly illustration and have very little writing.



a. Your book may look different than this. The book may be as long as 10 pages. Be sure each picture you choose or draw fits the part of the story on that page.

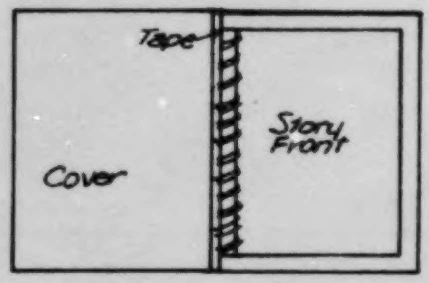
b. Make the pages of the book 8½ by 11 inches. They can be any color.

c. Cut a piece of white paper for each page of the story. Carefully print the part of the story for that page, making sure the picture will fit above the story. Paste onto the 8½ by 11 book paper.

d. Color the pictures on a separate piece of paper. Then cut them out and paste onto 8½ by 11 book page (see above). Be sure that it will fit above the text.

e. When you are finished with the story, add one blank sheet at the beginning and end and staple the pages together (see below). Use enough staples to hold the book together firmly.

f. Cut out a piece of heavy construction paper to go around the whole book. It should be a little larger and wider than the pages. Put the title on the cover and any illustration you want. Open the front cover of the book. Put one side of a piece of book tape on the edge of the story, and one side of the tape on the cover (see below). Do the same thing inside the back cover.



g. The book can now be placed in the library, another classroom or in your own classroom.

EXTENDED ACTIVITY

1. Make an illustration depicting your legend on a piece of white 8½-by-11-inch typing paper, using fabric crayons. Following crayon instructions, transfer your legend onto fabric. The illustrations could also be appliqued on a T-shirt or used as part of a class quilt.

2. Become an interviewer. Ask another student (or teacher) to play the part of one of the legendary characters discussed in the stories. Interview that legendary person. Write below the questions you want to ask.

1.

2.

3.

4.

Record or, if possible, videotape the interviews to be used in ways such as: sharing at Parent's Night; sharing with younger students; or building a volcano reference library.

NAME: ______________________________ DATE: ______________

MYTHS

REFERENCE ARTICLES:

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1.

2.

3.

4.

5.

6.

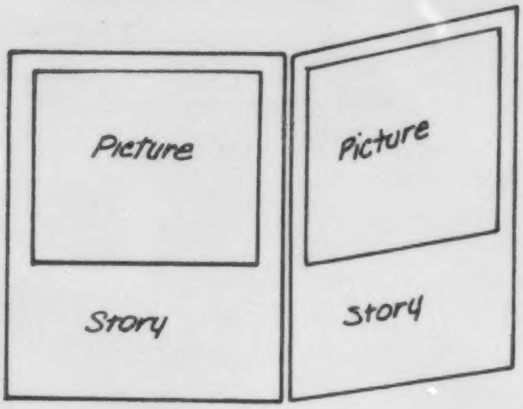
7.

8.

10. Write your story about Mount St. Helens. Be sure to include necessary words from the list you have just made in Question 8.

11. Repeat Steps 8-10, only find a new identity for another natural phenomenon, for example, hurricane.

12. Select one of your myths and write a book for younger students. Each page should be mostly illustration and have very little writing.



a. Your book may look different than this. The book may be as long as 10 pages. Be sure each picture you choose or draw fits the part of the story on that page.

b. Make the pages of the book 8½ by 11 inches. They can be color.

c. Cut a piece of white paper for each page of the story. Carefully print the part of the story for that page, making sure the picture will fit above the story. Paste onto the 8½ by 11 book paper.

d. Color the pictures on a separate piece of paper. Then cut them out and paste onto 8½ by 11 book page (see above). Be sure that it will fit above the text.

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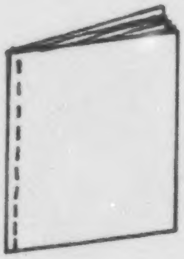

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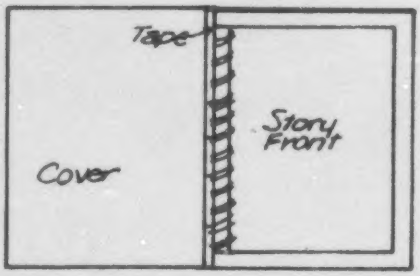

g. The book can now be placed in the library, another classroom or in your own classroom.

NAME: ______________________________ DATE: ______________

EXTENDED ACTIVITY

1. Make an illustration depicting your legend on a piece of white 8½-by-11-inch typing paper, using fabric crayons. Following crayon instructions, transfer your legend onto fabric. The illustrations could also be appliqued on a T-shirt or used as part of a class quilt.

2. Become an interviewer. Ask another student (or teacher) to play the part of one of the legendary characters discussed in the stories. Interview that legendary person. Write below the questions you want to ask.

1.

2.

3.

4.

Record or, if possible, videotape the interviews to be used in ways such as: sharing at Parent's Night; sharing with younger students; or building a volcano reference library.

LEVEL INFROMATION: LA P/I

VOLCANO WORD SEARCH

OBJECTIVE:
Students will increase their familiarity with terminology related to volcanoes.

TEACHER BACKGROUND:
Many terms used in the word searches are defined in "Glossary of volcanic terms" on Page 51 of Mount St. Helens.

VOLCANO WORD SEARCH — ACTIVITY I

REFERENCE:
— "Glossary of volcanic terms," page 51

PROCEDURE:
Listed below are 17 volcano words. See how many you can find in the word square.

V	E	N	T	S	Q	C	R	A	T	E	R
A	F	P	U	M	D	T	C	L	N	C	O
A	S	L	B	I	L	L	S	O	N	P	A
L	I	A	E	A	B	Q	C	N	O	L	D
0	X	V	S	T	O	O	N	E	M	U	D
N	B	A	T	H	T	U	M	U	A	G	V
E	B	S	W	K	E	Z	J	B	G	T	O
L	V	O	I	P	L	O	D	O	M	E	L
Y	L	C	O	D	S	O	M	E	A	G	C
F	L	L	G	H	I	N	Y	W	F	G	A
S	S	A	V	A	L	A	N	C	H	E	N
C	I	N	D	E	R	X	N	Z	C	S	O

Ash
Avalanche
Basalt
Cinder
Cone
Crater
Dome
Flow
Lava
Magma
Mud
Obsidian
Plug
Slope
Tubes
Vent
Volcano

ACTIVITY II

PROCEDURE:

Listed are 25 volcano words. Find them in the word square.

S	A	B	A	S	A	L	T	C	F	H	L	A	V	A	K	P	L	F	C
A	T	C	J	I	S	L	N	O	E	J	G	D	O	V	N	Y	M	L	O
B	D	R	D	H	H	E	R	U	P	T	I	O	N	A	S	R	T	O	M
M	L	K	A	C	K	W	R	V	I	Y	Z	Q	R	L	U	O	V	W	P
O	N	C	T	T	Q	P	X	M	M	Z	P	O	Y	A	W	C	X	Y	O
F	S	R	U	D	O	M	E	H	N	V	E	N	T	N	P	L	U	G	S
A	V	A	R	F	A	V	I	G	L	K	O	F	X	C	E	A	B	C	I
U	J	T	I	J	O	N	O	P	Z	S	J	L	U	H	W	S	D	A	T
L	E	E	M	L	K	R	Q	L	A	B	T	U	C	E	X	T	N	D	E
T	Q	R	G	H	P	U	M	I	C	E	I	H	Z	A	Y	I	B	O	P
P	H	J	G	L	F	K	E	C	Y	A	P	H	F	G	N	C	Q	C	Q
C	O	N	E	E	W	M	U	D	M	A	N	T	O	Z	T	O	S	R	R
Z	I	F	X	D	D	E	V	M	R	K	T	O	U	S	M	A	G	M	A
A	X	Y	R	X	W	W	V	G	U	L	U	B	S	J	U	C	X	D	T
I	S	L	O	P	E	O	O	P	T	N	B	E	C	I	V	U	K	C	N
B	J	Z	G	H	M	M	F	Q	S	O	E	T	B	V	H	W	E	O	A
K	O	N	M	S	S	Q	R	S	O	B	S	I	D	I	A	N	D	Z	M
L	Y	P	C	I	N	D	E	R	G	D	H	J	F	G	W	L	R	Y	R
A	Z	E	E	V	U	T	R	C	J	F	I	E	V	U	T	S	A	P	O
A	G	S	W	A	Y	B	X	F	U	M	A	R	O	L	E	M	N	Q	D

Ash
Avalanche
Basalt
Cinder
Cone
Crater
Dome
Dormant

Eruption
Fault
Flow
Fumarole
Lava
Magma
Mud
Obsidian
Plug

Pumice
Pyroclastic
Seismograph
Slope
Stratovolcano
Tubes
Vent
Volcano

44

NAME: ______________________________ DATE: ______________

VOLCANO WORD SEARCH — ACTIVITY I

REFERENCE:

— "Glossary of volcanic terms," page 51

PROCEDURE:

Listed below are 17 volcano words. See how many you can find in the word square.

V	E	N	T	S	Q	C	R	A	T	E	R
A	F	P	U	M	D	T	C	L	N	C	O
A	S	L	B	I	L	L	S	O	N	P	A
L	I	A	E	A	B	Q	C	N	O	L	D
0	X	V	S	T	O	O	N	E	M	U	D
N	B	A	T	H	T	U	M	U	A	G	V
E	B	S	W	K	E	Z	J	B	G	T	O
L	V	O	I	P	L	O	D	O	M	E	L
Y	L	C	O	D	S	O	M	E	A	G	C
F	L	L	G	H	I	N	Y	W	F	G	A
S	S	A	V	A	L	A	N	C	H	E	N
C	I	N	D	E	R	X	N	Z	C	S	O

Ash
Avalanche
Basalt
Cinder
Cone
Crater
Dome
Flow
Lava
Magma
Mud
Obsidian
Plug
Slope
Tubes
Vent
Volcano

NAME: ______________________________ DATE: ______________

ACTIVITY II

PROCEDURE:
Listed are 25 volcano words. Find them in the word square.

S	A	B	A	S	A	L	T	C	F	H	L	A	V	A	K	P	L	F	C
A	T	C	J	I	S	L	N	O	E	J	G	D	O	V	N	Y	M	L	O
B	D	R	D	H	H	E	R	U	P	T	I	O	N	A	S	R	T	O	M
M	L	K	A	C	K	W	R	V	I	Y	Z	Q	R	L	U	O	V	W	P
O	N	C	T	T	Q	P	X	M	M	Z	P	O	Y	A	W	C	X	Y	O
F	S	R	U	D	O	M	E	H	N	V	E	N	T	N	P	L	U	G	S
A	V	A	R	F	A	V	I	G	L	K	O	F	X	C	E	A	B	C	I
U	J	T	I	J	O	N	O	P	Z	S	J	L	U	H	W	S	D	A	T
L	E	E	M	L	K	R	Q	L	A	B	T	U	C	E	X	T	N	D	E
T	Q	R	G	H	P	U	M	I	C	E	I	H	Z	A	Y	I	B	O	P
P	H	J	G	L	F	K	E	C	Y	A	P	H	F	G	N	C	Q	C	Q
C	O	N	E	E	W	M	U	D	M	A	N	T	O	Z	T	O	S	R	R
Z	I	F	X	D	D	E	V	M	R	K	T	O	U	S	M	A	G	M	A
A	X	Y	R	X	W	W	V	G	U	L	U	B	S	J	U	C	X	D	T
I	S	L	O	P	E	O	O	P	T	N	B	E	C	I	V	U	K	C	N
B	J	Z	G	H	M	M	F	Q	S	O	E	T	B	V	H	W	E	O	A
K	O	N	M	S	S	Q	R	S	O	B	S	I	D	I	A	N	D	Z	M
L	Y	P	C	I	N	D	E	R	G	D	H	J	F	G	W	L	R	Y	R
A	Z	E	E	V	U	T	R	C	J	F	I	E	V	U	T	S	A	P	O
A	G	S	W	A	Y	B	X	F	U	M	A	R	O	L	E	M	N	Q	D

Ash
Avalanche
Basalt
Cinder
Cone
Crater
Dome
Dormant
Eruption
Fault
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Fumarole
Lava
Magma
Mud
Obsidian
Plug
Pumice
Pyroclastic
Seismograph
Slope
Stratovolcano
Tubes
Vent
Volcano

46

LEVEL INFORMATION: LA/SCI I

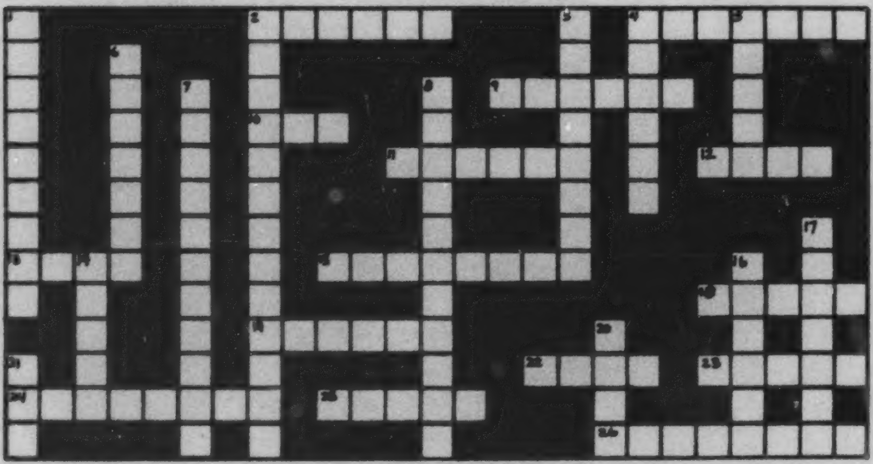
ERUPT-A-WORD PUZZLE

OBJECTIVE:
To familiarize the students with various volcano terms and/or definitions.

TEACHER BACKGROUND:
Students should be familiar with the words used in this puzzle before attempting to solve it.

ERUPT-A-WORD PUZZLE

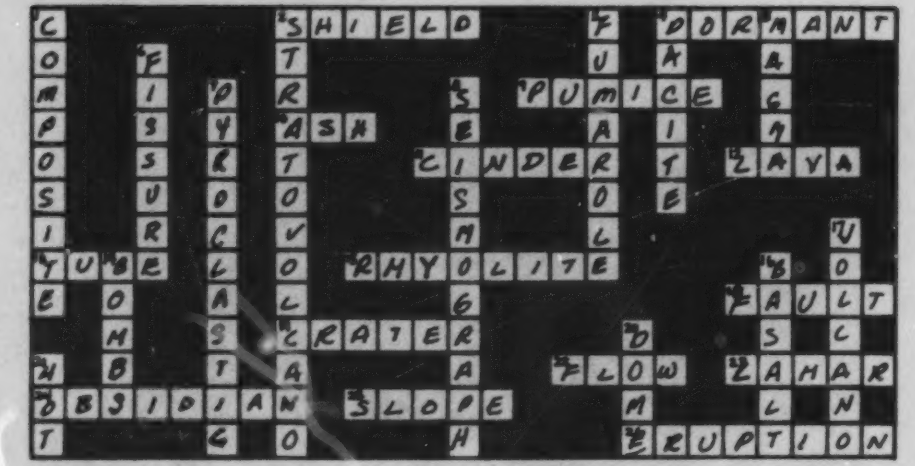
REFERENCE:
— "Glossary of volcanic terms," Page 51



ACROSS:
2. Broad, sloping volcano
4. "Sleeping"
9. Buoyant, solidified rock-glass
10. Pulverized rock from eruption
11. Loose, fragmental volcanic cone
12. Magma which has reached the surface
13. Cave inside a lava flow
15. Lava rock rich in silica and glass
18. Crack in earth's surface
19. Bowl-shaped hollow at or near top of volcano
22. Lava________________
23. Indonesian term for volcanic mudflow
24. Dense, black, glassy, volcanic rock
25. Incline
26. Ejection of solid, liquid and gaseous materials

DOWN:
1. Lava cone made of lava flows and fragmental materials
2. A composite volcanic cone
3. Vent issuing steam or other gases
4. Thick, pasty lava with high silica content
5. Molten rock beneath earth's surface
6. Cracks on slopes of volcano
7.____________________ flow; flow of hot gas and fragmental material
8. Instrument that records earthquakes
14. Fragment of molten rock blown from volcano and shaped during flight and impact
16. Lava poor in silica, rich in magnesium
17. Mountain built by eruption
20. Rounded pile of lava formed by eruption
21.________________________ avalanche; glowing avalanche

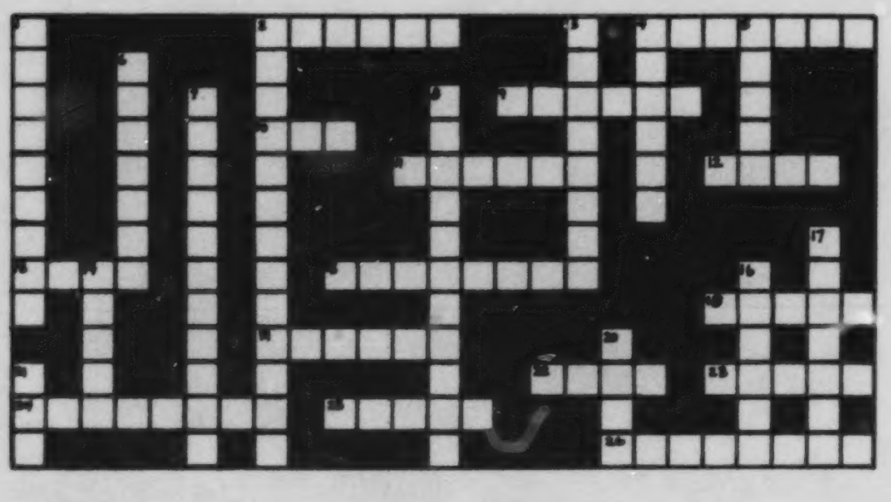
ERUPT-A-WORD PUZZLE KEY


COMPOSITE
SHIELD
STRATOVOLCANO
FUMAROLE
DORMANT
DACITE
MAGMA
FISSURE
PYROCLASTIC
SEISMOGRAPH
PUMICE
ASH
CINDER
LAVA
TUBE
BOMB
RHYOLITE
VOLCANO
BASALT
FAULT
CRATER
DOME
HOT
FLOW
LAHAR
OBSIDIAN
SLOPE
ERUPTION

NAME: ______________________________ **DATE:** ______________

ERUPT-A-WORD PUZZLE

REFERENCE:
— "Glossary of volcanic terms," Page 51



ACROSS:

2. Broad, sloping volcano
4. "Sleeping"
9. Buoyant, solidified rock-glass
10. Pulverized rock from eruption
11. Loose, fragmental volcanic cone
12. Magma which has reached the surface
13. Cave inside a lava flow
15. Lava rock rich in silica and glass
18. Crack in earth's surface
19. Bowl-shaped hollow at or near top of volcano
22. Lava ______________
23. Indonesian term for volcanic mudflow
24. Dense, black, glassy, volcanic rock
25. Incline
26. Ejection of solid, liquid and gaseous materials

DOWN:

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2. A composite volcanic cone
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5. Molten rock beneath earth's surface
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14. Fragment of molten rock blown from volcano and shaped during flight and impact
16. Lava poor in silica, rich in magnesium
17. Mountain built by eruption
20. Rounded pile of lava formed by eruption
21. ______________ avalanche; glowing avalanche

LEVEL INFORMATION: SCI P/I

MOUNT ST. HELENS — A SCALE MODEL DOWN TO THE MAGMA

OBJECTIVE:

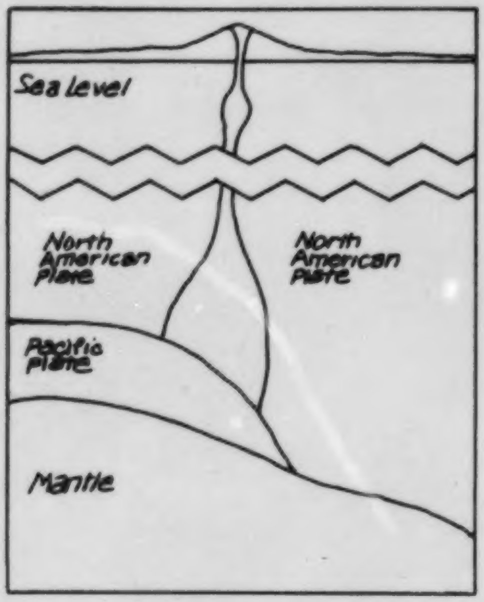
Using a scale drawing and enlarging it, the teacher will construct a cross-section model of Mount St. Helens as it was in 1979, including subterranean features down to the earth's mantle and engage students in a study of it.

TEACHER BACKGROUND:

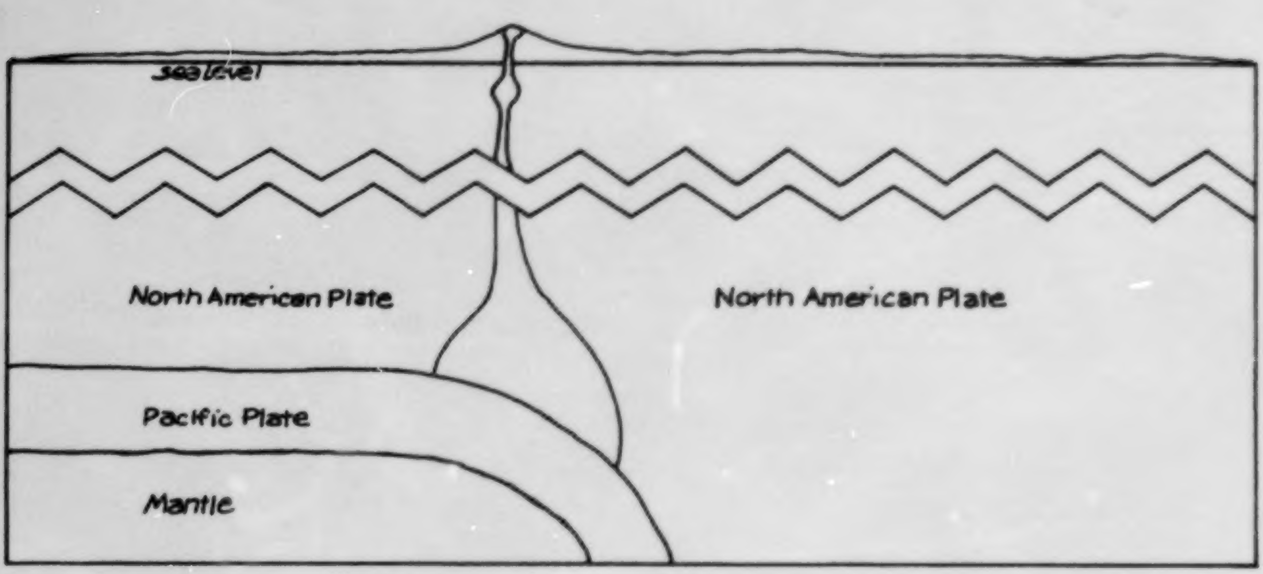
The geological theory behind this model is that of plate tectonics. As applied to this model, the theory is briefly this: Some deep earthquakes and the melting of rocks are caused by friction between plate-like bodies of rock forming the earth's crust when the plates underlying the oceans push under the plates carrying the continents. Mechanical movement causes quaking; the heat of friction helps melt rock, making magma.

PREPARATION:

1. The articles "Plate theory links Red Sea" in Appendix II and "More eruptions" on Page 50 will provide further information for this activity.
2. You will need the following materials:
   - — Plasticene, play dough, or salt and flour dough
   - — Large box such as refrigerator box or upright vacuum cleaner box, at least — 80 cm tall
   - — White butcher paper
   - — Poster paints and brushes
   - — Dish detergent
   - — Opaque projector for enlarging, or meter stick for enlarging by squares
   - — Cards
   - — Glue for labeling finished model
3. The accompanying diagram can be used on a box 80 cm tall, or enlarged for use on a taller box. It can also be used to create a floor-to-ceiling mural.
4. Paint one side of the box white or cover it with butcher paper to make it easy to draw on.
5. Cut the accompanying diagram along the zig-zag, spread it so that sea level and the top of the Pacific Plate are 60 cm apart, and attach it to butcher paper.
6. Enlarge the below-sea-level part of the spread-out diagram onto the side of the large box, using an opaque projector or enlarging by squares, to utilize the full size of the box. The top of the box represents sea level. The proportions of the box may make it necessary to extend the diagram vertically, in which case you can fill the space at the bottom with more mantle:



. . . or horizontally, in which case the diagram will look like this:

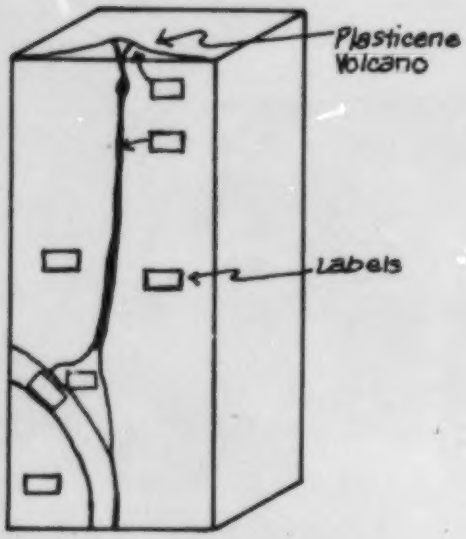


7. Enlarge the above-sea-level part of the diagram to the same scale on a strip of butcher paper. This strip will guide the making of the plasticene or dough mountain. Without it, the tendency is to make the mountain much too large.

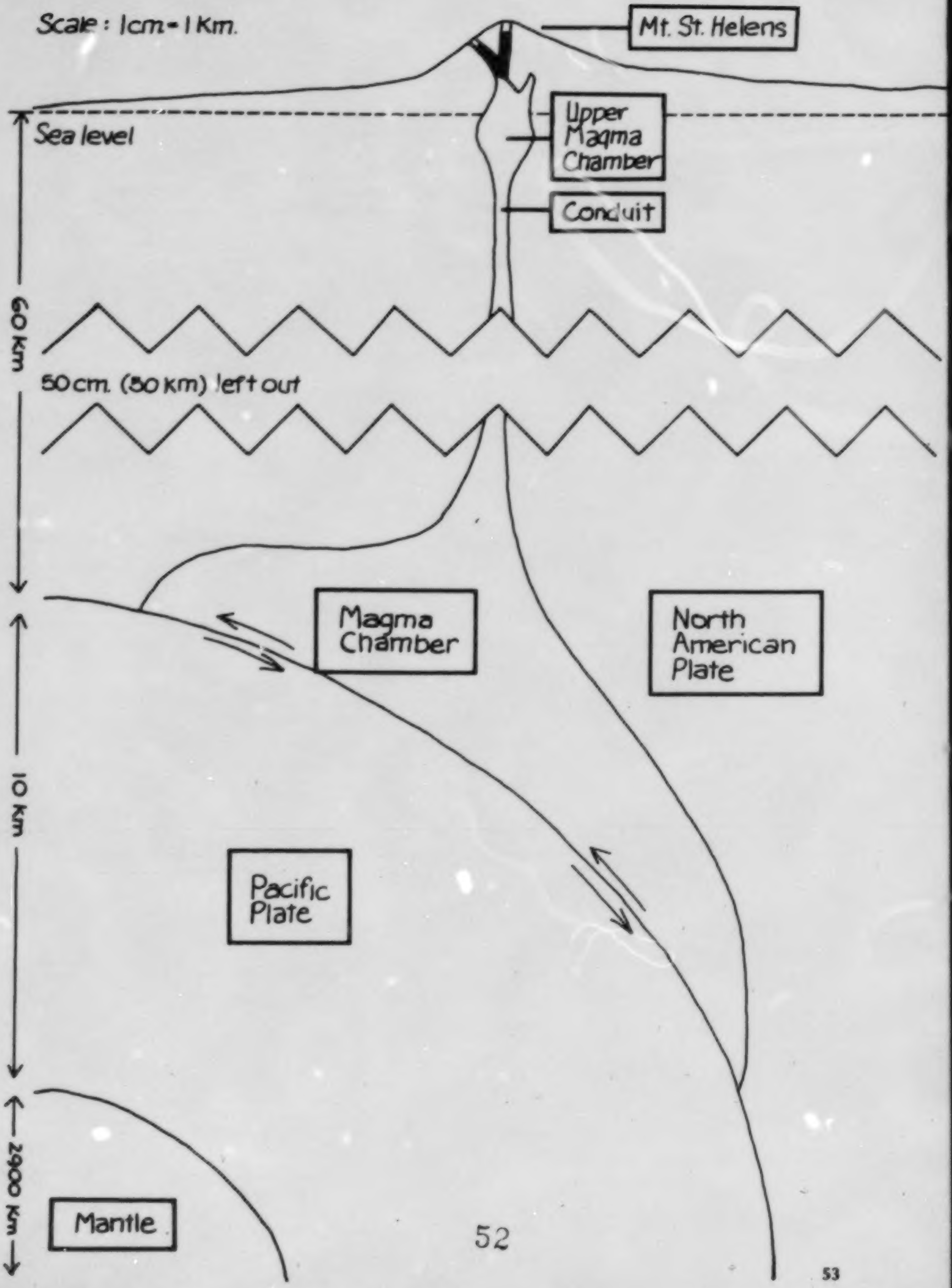
8. Make plasticene or dough model of volcano and land to east and west. Most of the top of the box may merely be painted green, or left as is, if you wish. Set the model at the edge of the box over the volcanic conduit. (See Clay Model Activity)

9. Paint the model, using red for the magma chambers, merging into black for the plug, orange for the mantle, black for the Pacific plate, and brown for the North American plate. The poster paint can be made to adhere to the plasticene by mixing it with dish detergent.

10. Make labels for the parts of the model and glue them in place. Your model should now resemble this:



Red color for magma should extend from lower chamber through conduit to upper chamber.


Scale: 1cm = 1 Km.
Mt. St. Helens
Upper Magma Chamber
Conduit
Sea level
60 Km
50 cm. (50 Km) left out
Magma Chamber
North American Plate
10 Km
Pacific Plate
2900 Km
Mantle

MOUNT ST. HELENS — A SCALE MODEL DOWN TO THE MAGMA

PROCEDURE:
Study the model and answer the study questions.

STUDY QUESTIONS:

1. What part of the model heats up the rock for the magma chamber?

The area between the North American plate and the Pacific plate.

2. What is the lower and upper magma chamber?

The lower chamber is where melting occurs, and the upper chamber is where melted rock accumulates.

3. Great pressure may develop in the upper magma chamber (similar to a shaken pop bottle). What keeps the volcano from erupting all the time?

A plug or dome seals the gases and magma inside the volcano.

4. What would you liken this to in a pop bottle?

The bottle cap is like the plug.

NAME: ______________________________ DATE: ______________

MOUNT ST. HELENS — A SCALE MODEL DOWN TO THE MAGMA

PROCEDURE:
Study the model and answer the study questions

STUDY QUESTIONS:

1. What part of the model heats up the rock for the magma chamber?

2. What is the lower and upper magma chamber?

3. Great pressure may develop in the upper magma chamber (similar to a shaken pop bottle). What keeps the volcano from erupting all the time?

4. What would you liken this to in a pop bottle?

LEVEL INFORMATION: SCI/LA P

ORDERING THINGS

OBJECTIVES:
The students will:
1. Demonstrate their ability to place pictures in sequence of left to right.
2. Demonstrate their ability to recognize specific letters of the alphabet.
3. Demonstrate their ability to respond to similarities in pictures.

TEACHER BACKGROUND:

Students will need some explanation as to what is taking place when sequencing pictures before trying to place them in order.

TEACHING SUGGESTIONS:

1. Put a selection of pictures in proper sequence.

a. Cut out and mount on a flannel board in any order several pictures from "Mount St. Helens".

b. Attach the pictures on the flannel board.

c. Have individuals or groups of students place the pictures in the sequential order, left to right. Suggested pictures to use are ash movement diagrams (Page 20) and eruption sequence (Page 12).

2. Print the letters of the alphabet on the chalkboard. Tell the students to find the letters in the headlines in "Mount St. Helens" and circle them with a red crayon.

3. Cut out and mount on tagboard several pictures from "Mount St. Helens". Use pictures with similar characteristics. Hold the pictures up for groups of students to see. Have the students point to the same pictures in their copy of the tabloid.

Suggested pictures to use:
— Page 50 — Spirit Lake after May 18 eruption
— Page 3 — Horseback rider near mountain
— Page 5 — Photo, artist's conception of 19th-century St. Helens eruption.
— Page 14 — Eruption picture

Other suggested pictures:
— Page 31 — Part of state highway washed out by mudflow
— Page 30 — Road clearing along Toutle
— Page 16 — Fallen timber
— Page 46 — Steam rising from Toutle River
— Page 48 — Fallen timber

LEVEL INFORMATION: SS/LA I

ACTIVITY I — PREDICTIONS

OBJECTIVES:
The students will:
1. Define "prediction."
2. Describe how predictions are related to Mount St. Helens.
3. Apply the definition for prediction to making a prediction.
4. Compare scientific and non-scientific predictions.

TEACHER BACKGROUND:

To study a volcano in action is a once-in-a-lifetime experience for most geologists. Mount St. Helens has been dormant for 123 years. A minor earthquake measuring 4.1 on the Richter Scale occurred on March 20, 1980. On March 26, 1980, federal, state and local officials met to discuss possible evacuation procedures.

On March 27, 1980, a loud boom was heard 40 miles away. The eruption spread ash over 2 kilometres above the summit. Other eruptions took place, including the May 18, 1980, blast that was so destructive and caught many experts by surprise by its severity.

But prediction techniques improved. At 12:35 p.m. August 7, the USGS and US Forest Service ordered evacuation within the Red Zone, based on the predictions they had made as early as July 29 resulting from experience with the mountain and patterns that were emerging. At 4:28 p.m. that day, Mount St. Helens erupted again.

People look to geologists to be forecasters of volcanic activity. Geologists are expected to be like weathermen, who predict clear or cloudy skies. However, in their defense, it should be noted that little information is available to help these talented scientists predict volcanoes. One of the jobs of a geologist is to record the events as they occur in a volcano. Information is gained as the geologists make repeated observations. Patterns eventually emerge, making it possible to predict volcanic activities with increasing confidence and accuracy.

TEACHING SUGGESTIONS:

Assign articles to be read by the students or read the articles aloud to students. Discuss with students the meaning of the word "prediction." Predictions are somewhat more than a guess. They are based upon information gathered over a period of time.

Ask the student to look in the articles for clues that helped forecast the eruption of Mount St. Helens. Ask students to report clues they found. Use the questions as guides for open discussion. Accept any reasonable answer.

After finishing this unit you may want to review the unit on Harry Truman. (See Table of contents).

ACTIVITY 1 — PREDICTIONS

REFERENCE ARTICLES:
- "Geologist calms Toutle residents," Page 6.
- "Prediction found in rock," Page 6.
- "Predictions more accurate as time goes on", Page 6.
- "Pains give psychic hint on St. Helens," Page 7.

PROCEDURE:

Read the articles on Pages 6 and 7 of "Mount St. Helens." Answer the following questions:

1. What is a prediction?

A carefully made scientific forecast based on all the information available.

2. Did ancient civilizations predict the future? Were they accurate?

Yes. In many cases, the ancients came very close to accurately predicting modern events.

3. Using the definition for prediction, make a prediction about something, e.g. weather, elections, a friend. What was the basis for your prediction?

Answers should show application of the definition. The prediction should be based on some type of objective information.

4. If you lived on the Toutle River, how would you have felt about a geologist telling you that Mount St. Helens might erupt? Would you stay or leave? Explain your answer.

Many answers are acceptable. The student should take a position and defend it.

5. Define "precaution."

Planning to react to a disaster.

6. What precautions were taken before and after the May 18, 1980, eruption?

Students should list such precautions as U.S. Forest Service Red Zones, Toutle evacuation plans, etc. After the eruption of May 18, 1980, more precautions were taken, such as plans to evacuate several cities.

7. If you lived near a mountain with a volcanic history, would Mount St. Helens make you take a second look at your mountain's activity? If yes, explain your answer.

Students should indicate two or three reasons for answer — comparison, similar history, distance from mountain.

ACTIVITY II — MAKE YOUR OWN PREDICTIONS

PROCEDURE:

Bring a rock to school. It should be interesting to you.

QUESTIONS:

1. Find pictures in your rock. Tell about the pictures you have imagined.

Encourage students to use their imagination to create ideas from patterns in their rock.

2. What might your rock foretell.

Any answer is acceptable here.

3. How is a rock prediction different than a scientific prediction?

The rock prediction is not based on fact, while scientific predictions are.

4. (a) The scientific community might have strong objections to articles such as "Prediction found in rock." How do you think scientists feel about such articles?

Scientists fear people may not realize that their predictions are scientific, not intuitive. Some readers may have more faith in rocks instead of scientists.

(b) Why do they feel this way?

This misconception limits the effectiveness of the scientist.

(c) How might a scientist combat these articles?

A scientist needs to gain credibility by having their experiments publicized through various media. If science communicates with the layman, they eventually may lend less credence to the soothsayer.

NAME: ______________________________ **DATE:** ______________

ACTIVITY I — PREDICTIONS

REFERENCE ARTICLES:

- "Geologist calms Toutle residents," Page 6.
- "Prediction found in rock," Page 6.
- "Predictions more accurate as time goes on," Page 6.
- "Pains give psychic hint on St. Helens," Page 7.

PROCEDURE:

Read the articles on Pages 6 and 7 of "Mount St. Helens." Answer the following questions:

1. What is a prediction?

2. Did ancient civilizations predict the future? Were they accurate?

3. Using the definition for prediction, make a prediction about something, e.g. weather, elections, a friend. What was the basis for your prediction?

4. If you lived on the Toutle River, how would you have felt about a geologist telling you that Mount St. Helens might erupt? Would you stay or leave? Explain your answer.

5. Define "precaution."

6. What precautions were taken before and after the May 18, 1980, eruption?

7. If you lived near a mountain with a volcanic history, would Mount St. Helens make you take a second look at your mountain's activity? If yes, explain your answer.

NAME: ________________________________ **DATE:** ______________

ACTIVITY II — MAKE YOUR OWN PREDICTIONS

PROCEDURE:

Bring a rock to school. It should be interesting to you.

QUESTIONS:

1. Find pictures in your rock. Tell about the pictures you have imagined.

2. What might your rock foretell.

3. How is a rock prediction different than a scientific prediction?

4. (a) The scientific community might have strong objections to articles such as "Prediction found in rock." How do you think scientists feel about such articles?

   (b) Why do they feel this way?

   (c) How might a scientist combat these articles?

LEVEL INFORMATION: SCI P/I

DEMONSTRATION — FUMAROLES

OBJECTIVE:

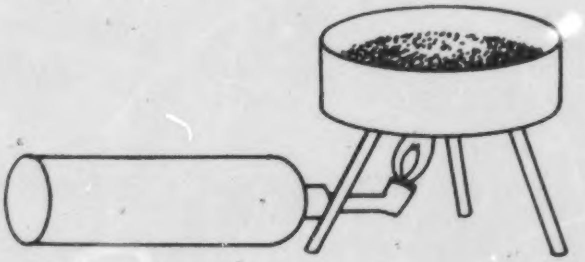
The students will observe how fumarole activity forms around volcanic areas.

MATERIALS:

Small metal cup (or shallow can such as a tuna fish can)
Fine sand
Tripod (or other stand)
Bunsen burner (propane torch)
Water
Ice cube

PROCEDURE:

1. Place the can on the stand.
2. Add about ¼ inches to ½ inches sand.
3. Moisten the sand (not wet).
4. Heat the can thoroughly with the burner or torch. The can should get very hot.
5. When an area of sand is dry, fumarole activity should become evident. The students should take note of the action of steam on the sand particles and record their observations on the fumarole data sheet.
6. Make a well in another section of dry, hot sand. Drop an ice cube into it. The students should observe more intense fumarole activity. The description of this action should be included on the fumarole data sheet.



DEMONSTRATION — FUMAROLE ACTIVITY

REFERENCES:

— "Quiet broken by new eruptions, more bulging," Page 11

BACKGROUND:

Shortly after the May 18 eruption, observers flying over the devastated area north of Mount St. Helens reported a large steam and ash eruption near the former south shore of Spirit Lake.

They observed the eruption was coming from a small crater. Some people speculated that the volcano had opened up a new vent.

Later observations by USGS scientists determined that some sizable steam eruptions were occurring in the area. However, these were fumaroles (steam eruptions); not true volcanic eruptions. These occur when ground water or melt-water from buried ice blocks seep into the superheated material from the volcano. The water turns to steam and explodes as a plume, sometimes carrying ash with it. The underground temperature in the ash flow at a depth of a few feet was measured as high as 330 degrees Celsius many days after the eruption. Small steam vents, or fumaroles, are expected to continue for some time.

PROCEDURE:

Record on the fumarole data sheet a description of the sand activity both with and without the ice cube.

STUDY QUESTIONS:

1. What is the cause of a fumarole?

Heated material from underground releases gases, including steam which rises through weak areas and is vented into the air.

2. What might cause fumaroles to be formed where volcanic ash flows cover a lake (Spirit Lake near Mount St. Helens)?

As water seeps into the pyroclastic flow material, steam is generated, sometimes creating spectacular eruptions.

3. When the ice cube was dropped in the sand well, the sand activity was greater. Why?

There is a greater temperature differential from surface (cold) to subsurface (hot). The water bubbles with the sand.

DESCRIPTION OF SAND

1. Hot sand	**Answers vary**
2. Ice cube in sand	**Answers vary**

NAME: ______________________________ DATE: ______________

DEMONSTRATION — FUMAROLE ACTIVITY

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Shortly after the May 18 eruption, observers flying over the devastated area north of Mount St. Helens reported a large steam and ash eruption near the former south shore of Spirit Lake.

They observed the eruption was coming from a small crater. Some people speculated that the volcano had opened up a new vent.

Later observations by USGS scientists determined that some sizable steam eruptions were occurring in the area. However, these were fumaroles (steam eruptions); not true volcanic eruptions. These occur when ground water or melt-water from buried ice blocks seep into the superheated material from the volcano. The water turns to steam and explodes as a plume, sometimes carrying ash with it. The underground temperature in the ash flow at a depth of a few feet was measured as high as 330 degrees Celsius many days after the eruption. Small steam vents, or fumaroles, are expected to continue for some time.

PROCEDURE:

Record on the fumarole data sheet a description of the sand activity both with and without the ice cube.

STUDY QUESTIONS:

1. What is the cause of a fumarole?

2. What might cause fumaroles to be formed where volcanic ash flows cover a lake (Spirit Lake near Mount St. Helens)?

3. When the ice cube was dropped in the sand well, the sand activity was greater. Why?

DESCRIPTION OF SAND

1. Hot sand	
2. Ice cube in sand	

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LEVEL INFORMATION: SCI P/I

EARTHQUAKES — HERALD OF WHAT IS TO COME, BUT WHEN? . . .

OBJECTIVE:

The students will describe the lack of correlation between earthquakes and the May 18, 1980, eruption of Mount St. Helens, and how harmonic tremors are being used to predict eruptions now.

TEACHING SUGGESTIONS:

Explain the histogram activity. Be sure they also examine the ash/steam eruptions, located on the top portion of the graph.

EARTHQUAKES — HERALD OF WHAT IS TO COME, BUT WHEN? . . .

REFERENCE ARTICLES:
— Photo, Page 8
— "Awakening: Officials warn of avalanche danger," Page 8.
— "Quakes weak compared to SF disaster," Page 9
— "Two types of shakes," Page 9
— "Harmonic tremors' noted," Page 9
— "Predictions more accurate as time goes on," Page 6

MATERIALS:
Earthquake activity/hour sheet
Pencil
Appendix VI, Earthquakes and other data from Mount St. Helens

PROCEDURE:

Between March 20 and May 18, many small earthquakes occurred. These could not be felt but were recorded on seismographs. For example, on March 27, 135 earthquakes were recorded with a magnitude of 3.0 or greater.

1. Look at Column A in Table 1. The data are arranged into groups of three days.
2. Plot the average number of earthquakes per hour on the histogram for each three day period. Twenty points will be plotted. May 17 is done for you.

QUESTIONS:

1. Do you see from your graph any way the geologist could have predicted the major eruption? Why?

No. Except for May 27 when the large number of earthquakes coincided with an eruption, no other correlation can be made. This was a disappointment to the geologists.

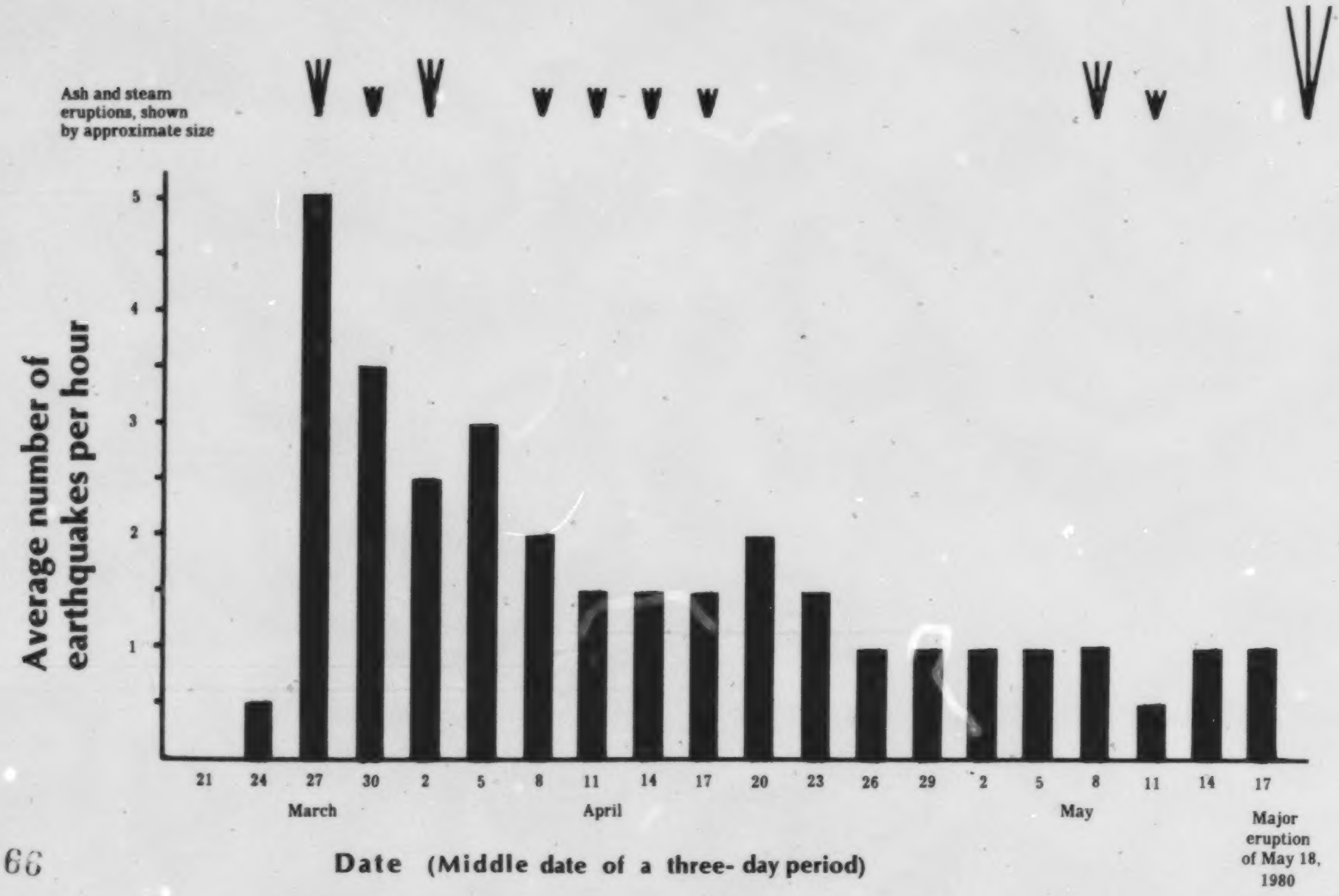
2. Read the article "Predictions more accurate as time goes on," Page 6. Earthquake activity seems to be used as part of the prediction for eruptions now. Why?

The harmonic tremors lasting at least a half hour have always been followed by an eruption.

3. What else is now used to predict an eruption besides the harmonic tremors?

Decrease in CO_2 and SO_2 output, indicating a pressure build-up.

Average earthquake activity per hour



NAME: ______________________________ DATE: ______________

EARTHQUAKES — HERALD OF WHAT IS TO COME, BUT WHEN? . . .

REFERENCE ARTICLES:
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MATERIALS:
Earthquake activity/hour sheet
Pencil
Appendix VI, Earthquakes and other data from Mount St. Helens

PROCEDURE:

Between March 20 and May 18, many small earthquakes occurred. These could not be felt but were recorded on seismographs. For example, on March 27, 135 earthquakes were recorded with a magnitude of 3.0 or greater.

1. Look at Column A in Table 1. The data are arranged into groups of three days.
2. Plot the average number of earthquakes per hour on the histogram for each three day period. Twenty points will be plotted. May 17 is done for you.

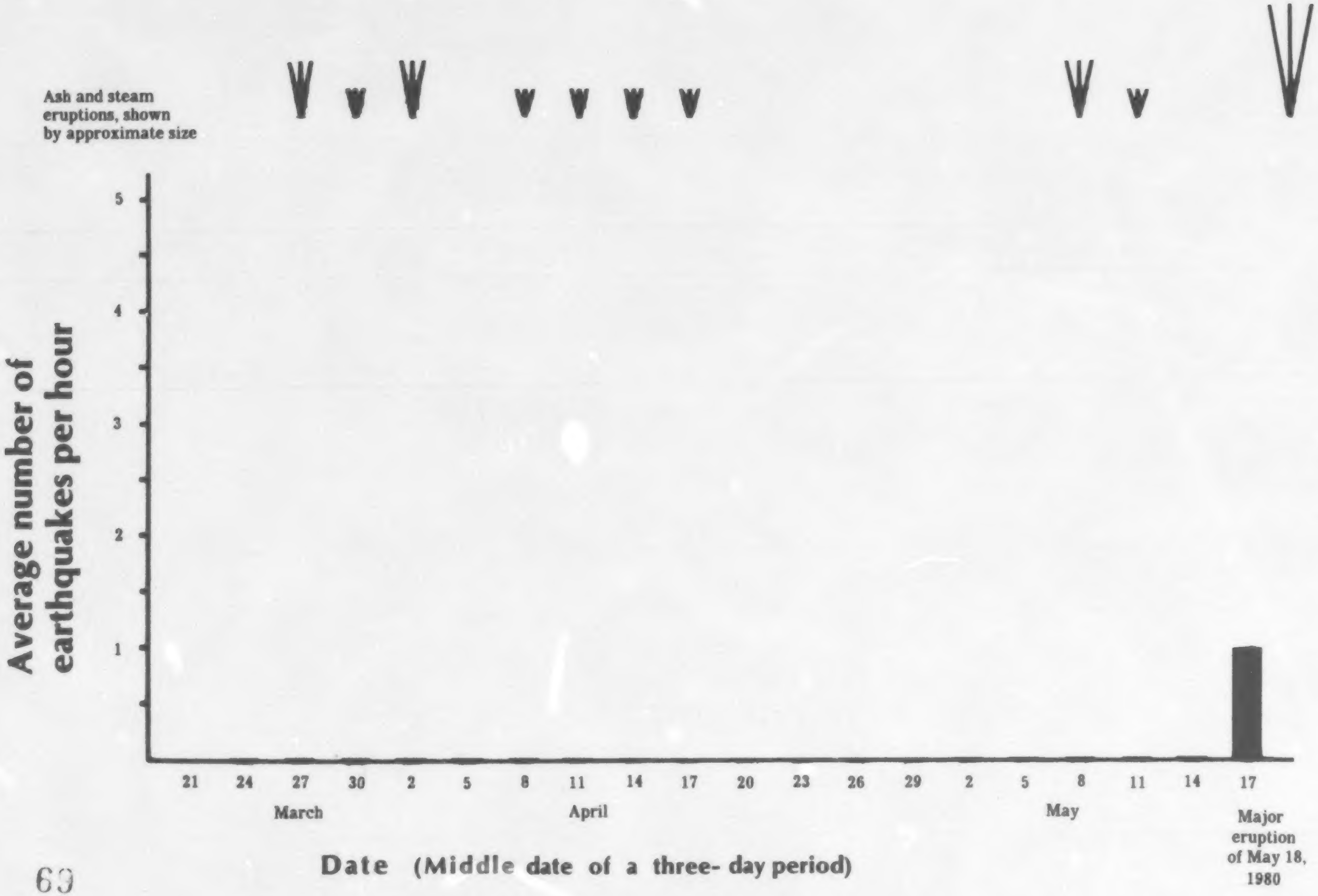
QUESTIONS:

1. Do you see from your graph any way the geologist could have predicted the major eruption? Why?

2. Read the article "Predictions more accurate as time goes on," Page 6. Earthquake activity seems to be used as part of the prediction for eruptions now. Why?

3. What else is now used to predict an eruption besides the harmonic tremors?

Average earthquake activity per hour



LEVEL INFORMATION: SCI P/I

DEMONSTRATION: THERE'S NOTHING LIKE A WARM COLA

OBJECTIVES:
The students will:
1. **Observe and describe the effect heat has on the stability of a gas.**
2. **Compare a bottle of pop that has been shaken to Mount St. Helens.**

MATERIALS NEEDED:
Two unopened bottles of the same kind of pop.
Bottle opener.

TEACHING SUGGESTIONS:
Procedure:
1. **Refrigerate one bottle of pop. Put the other bottle of pop in a warm place. When you do this activity, it is important that the two bottles of pop are quite different in temperature.**
2. **Give the two bottles of pop to one student to shake vigorously. The student should hold them together. It is important that the amount of shaking is exactly the same.**
3. **Set the bottles on a table and select some brave student to open the bottles.**
4. **Before the bottles are opened, have the student record predictions. NOTE: This activity should probably be done outside.**

DEMONSTRATION: THERE'S NOTHING LIKE A WARM COLA

REFERENCE ARTICLES:
— "Nature uncorked a powerful bottle," Page 18
— Photomicrograph of Ash, Page 23

PROCEDURE:
1. Record your prediction about the demonstration below.

Answers vary

2. Observe the pop bottle demonstration.

3. Answer the following questions.

QUESTIONS:
1. What happened when the bottles were opened?

A mixture of gas and liquid erupted from the bottles. The bottle which was warm lost more liquid than the one which was cold.

2. Where was the gas before the bottles were opened?

It was in a liquid form as part of the pop. The CO_2 was present but not as a gas because it was contained within the confining space of the bottle.

3. Why did the gas rush out?

When the bottle was opened, the pressure was released. The liquid CO_2 changed to a gas, which occupied more space. Thus, the gas rushed out, carrying with it some of the liquid pop.

4. Do you think the amounts of CO_2 were different before the bottles were open?

No. The amount should have been the same.

5. Why did one bottle erupt more violently than the other?

The liquid is more stable in the colder liquid. At higher temperatures, the CO_2 has greater tendency to convert to a gas.

6. In terms of pressure, what causes a volcano to erupt?

The heat of the volcano causes the gas to be under great pressure. If a crack develops so that the pressure is released, a rapid expansion occurs and the gases escape as a violent eruption. The expanding gas may carry with it some molten rock and pieces of solid rock from the volcano walls.

7. Some violent volcanic eruptions are accompanied by much pumice. Pumice is a glassy rock with many holes which will float on water. How do you think the pumice forms?

In the eruption, molten rock is carried out. Because it contains expanding gas, it may become a froth. When it cools quickly, the result is a glassy rock full of holes.

8. Look at the photograph of the ash (Page 23) that has been magnified 200 times. Do you think gases were involved in the formation of this ash? Why?

Yes. Some of the ash is really very fine-grained pumice. You can see that it consists of many gas holes.

NAME: ______________________________ DATE: ______________

DEMONSTRATION: THERE'S NOTHING LIKE A WARM COLA

REFERENCE ARTICLES:

- "Nature uncorked a powerful bottle," Page 18
- Photomicrograph of Ash, Page 23

PROCEDURE:

1. Record your prediction about the demonstration below.
2. Observe the pop bottle demonstration.
3. Answer the following questions.

QUESTIONS:

1. What happened when the bottles were opened?

2. Where was the gas before the bottles were opened?

3. Why did the gas rush out?

4. Do you think the amounts of CO_2 were different before the bottles were open?

5. Why did one bottle erupt more violently than the other?

6. In terms of pressure, what causes a volcano to erupt?

7. Some violent volcanic eruptions are accompanied by much pumice. Pumice is a glassy rock with many holes which will float on water. How do you think the pumice forms?

8. Look at the photograph of the ash (Page 23) that has been magnified 200 times. Do you think gases were involved in the formation of this ash? Why?

LEVEL INFORMATION: SCI P/I

MODEL OF A VOLCANO

OBJECTIVE:

Students will report the results of two simulations of eruptions in a volcano model, which may be a class project or a teacher demonstration.

MATERIALS:

6 oz. frozen juice or vegetable juice containers or small tuna cans will work well as "craters." Flexible tubing can be purchased in most science supply houses, or at a pharmacy.

Try a mixture of sand and flour for the "eruption."

Use as a class/individual project, or as a teacher demonstration.

TEACHING SUGGESTIONS:

If you decide to conduct an individual project:

1. **Class supervision of the procedures is necessary if students are to build their own models.**
2. **Decide whether this is an inside or outside activity.**
3. **You may want to have the students work in pairs to build their models. Each pair could build one model or help each other build their own model.**
4. **A large supply of newspaper for tables and floors will aid the clean-up operation.**
5. **Be sure tips are left on the top of the cone while plaster of Paris is being applied.**

If you decide to conduct a demonstration, which may be more advisable in the primary grades:

1. **Build a model of the volcano for the demonstration, following the directions 1-3 in "Procedure."**
2. **Have a student helper blow on the end of the tubing as described in directions 4 and 5.**
3. **Use the questions as a discussion guide.**

SAFETY NOTE: Do not attempt to simulate volcanic activity with potassium dichromate, since this has been identified as a health hazzard.

MODEL OF A VOLCANO

REFERENCE ARTICLES:

— "The three types of volcanoes," page 2

MATERIALS:

Scissors
Glue
Manila folder
Tin can
Plaster of Paris
Flexible tubing
Flour/sand mixture
Paint (optional)
Electric fan (optional)

PROCEDURE:

1. Make a hole near the bottom of a small tin can and insert a 12-inch piece of flexible tubing in the hole, the long end coming out of the bottom of the can.
2. Make the shape of the mountain by forming a cone of heavy paper over the can (See figure 1).

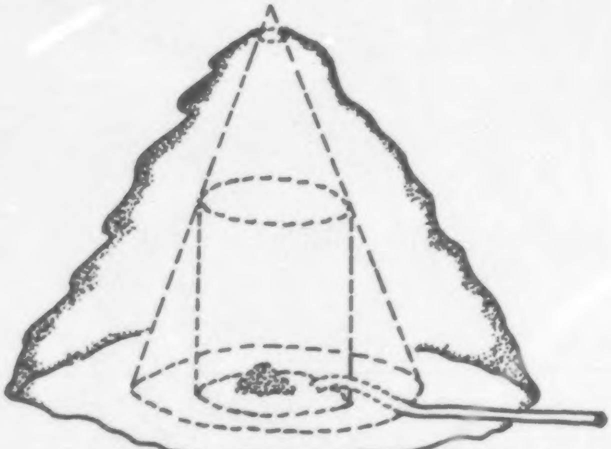


FIGURE 1

3. Coat the cone with plaster of Paris in a layer ¾ inch to 1 inch thick. Leave about 1 inch of the tip uncovered.
4. When the plaster of Paris is dry, cut the tip off the paper cone as shown in Figure 1. It may be painted.
5. Put some sand/flour mixture in the can, then blow on the end of the tubing. Notice what happens. Answer questions 1 and 2.
6. Blow into the tubing again, blowing harder this time and using your ideas for controlling the flow.
7. Answer questions 3 and 4.
8. Clean up the experiment.

QUESTIONS:

1. What happened when you blew on the tube?

A dust explosion.

2. Before blowing again, try to think of a way of controlling the flow so it will go in the direction you want. Tell us your idea by writing it down.

Another student blows from the side or waves a paper fan to create the wind. An electric fan might be used. An obstacle, such as a sheet of paper, might deflect the sand/flour.

3. What has happened to the sand/flour blown out of the volcano?

It is probably on the table top.

4. What is this similar to?

The ash fall of Mount St. Helens.

5. What was different when you blew harder?

More ash went farther.

6. How is this experiment similar to what happened at Mount St. Helens?

Answers will vary.

EXTENDED ACTIVITY

MATERIALS:
Flour paste
Map of Washington
Paint — various colors
Paint brush

PROCEDURE:

Make a model of Washington State using flour paste and sawdust. Label the mountains in Washington. The names of the mountains are: Mount Baker, Mount Rainier, Mount St. Helens and Mount Adams.

NAME: ______________________________ DATE: ______________

MODEL OF A VOLCANO

REFERENCE ARTICLES:
— "The three types of volcanoes," page 2

MATERIALS:

Scissors
Glue
Manila folder
Tin can
Plaster of Paris
Flexible tubing
Flour/sand mixture
Paint (optional)
Electric fan (optional)

PROCEDURE:

1. Make a hole near the bottom of a small tin can and insert a 12-inch piece of flexible tubing in the hole, the long end coming out of the bottom of the can.
2. Make the shape of the mountain by forming a cone of heavy paper over the can (See figure 1).

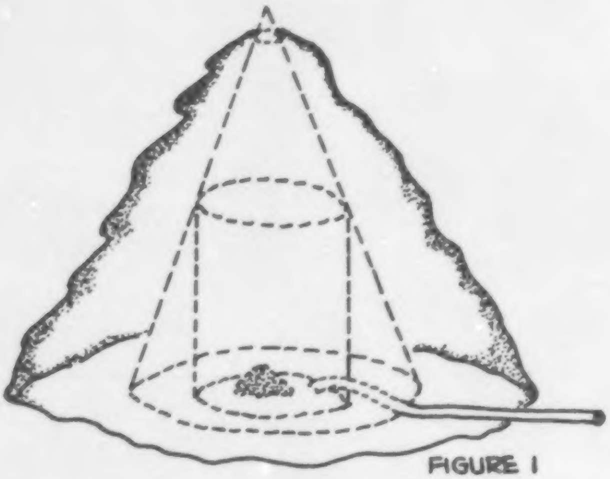


FIGURE 1

3. Coat the cone with plaster of Paris in a layer ¾ inch to 1 inch thick. Leave about 1 inch of the tip uncovered.
4. When the plaster of Paris is dry, cut the tip off the paper cone as shown in Figure 1. It may be painted.
5. Put some sand/flour mixture in the can, then blow on the end of the tubing. Notice what happens. Answer questions 1 and 2.
6. Blow into the tubing again, blowing harder this time and using your ideas for controlling the flow.
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QUESTIONS:

1. What happened when you blew on the tube?

2. Before blowing again, try to think of a way of controlling the flow so it will go in the direction you want. Tell us your idea by writing it down.

3. What has happened to the sand/flour blown out of the volcano?

4. What is this similar to?

5. What was different when you blew harder?

6. How is this experiment similar to what happened at Mount St. Helens?

EXTENDED ACTIVITY

MATERIALS:
Flour paste
Map of Washington
Paint — various colors
Paint brush

PROCEDURE:

Make a model of Washington State using flour paste and sawdust. Label the mountains in Washington. The names of the mountains are: Mount Baker, Mount Rainier, Mount St. Helens and Mount Adams.

LEVEL INFORMATION: SCI/MATH I

FIELDS AND FIELDS OF ASH

OBJECTIVES:
The students will:
1. **Given a map and grid overlay, determine the approximate area (in square miles) of the blowdown.**
2. **Calculate in familiar units the size of the blowdown area.**

TEACHING BACKGROUND
1. **The students will need some background in map reading, i.e. contour lines, scales, keys, etc. Football field dimensions are 50 x 120 yards (including end zones)**
2. **Have students do the topographic map activity to promote understanding of this skill.**
3. **Allow at least one half hour of class time so students can ask questions.**
4. **Thermofax several grids for student use.**

FIELDS AND FIELDS OF ASH

REFERENCES:
- "Searching: Helicopters comb 'hell on earth' to find survivors," Page 41.
- "Beautiful valley now desolate wasteland," Page 18.
- Sequence of events, page 16

MATERIALS:
Map of the zone of devastation.
Transparent grid overlay (each square equals one square mile)

PROCEDURE:
Read the reference articles.

1. Place grid of one-square-miles on map showing area of blast devastation (blowdown area.) Secure the grid with tape so it will not move after you start counting.

2. Count the number of squares of the grid that are completely within the blowdown area. If even the smallest part of the blowdown area lies outside the square, do not count it.
How many squares did you count?

The answer should be about 146 square miles. However, the answer will vary somewhat depending on the exact placement of the grid on the map.

3. Count the number of squares of the grid that are partly inside the blowdown area. All should be counted; some may be almost all inside and some may have only a corner inside. You are counting all the squares which include the boundary line. How many partial squares did you count?

The answer should be about 84 squares. Again, the answer will vary somewhat depending on the exact placement of the grid on the map.

4. Because some squares are almost all the way inside and some squares are just barely inside, you can guess that the average is about half in, half out. Divide your answer by 2 to figure the number of total whole squares.

$\frac{84}{2}$ = 42. Depending on answer in No. 3. This question may require more teacher explanation.

5. Add your values together. What was the total number of square miles of the blowdown area?

Answer should be about 188 square miles. Using the map published by the Washington State Department of Natural Resources, the number of square miles was found to be 186–188 square miles by a computer study.

6. How does your value compare to that published in the newspaper? How might this be explained?

One of the earlier values is given as 156 square miles, which seems to be too low. This was probably an early estimate before the exact boundaries of the blowdown area had been determined. However, it is likely that when the geologists study the area more carefully that a more precise value will be determined.

7. As it is sometimes difficult to visualize size, let's compare the size to that of a football field. How many football fields do you think would fit inside the blowdown area? (Make a guess).

Answers will vary.

8. One square mile could contain 516 football fields. Using the approximate value of 500, how many football fields would fit in the blowdown area?

94,000 football fields. If the value of 516 is used it would hold 97,008 football fields.

EXTENDED ACTIVITIES

1. If these football fields were laid end-to-end, how far would they stretch in miles? (About 15 football fields laid end-to-end would make up a mile.)

Answer is 6,266 miles based on 94,000 or 6,467 miles based on 97,008.

2. How far would this be in terms of the distance between New York City and San Francisco? (This distance is 2,566 miles.)

Answer is about 2½ times as far. The football fields would stretch from one city to the other and back again and halfway as a third trip.

3. The area of the state of Washington is approximately 68,200 square miles. What precentage of the state does the blowdown area represent?

188/68,200 equals 0.28 per cent
(Less than 3/10 of 1 per cent).

NAME: ____________________ DATE: __________

FIELDS AND FIELDS OF ASH

REFERENCES:
— "Searching: Helicopters comb 'hell on earth' to find survivors," Page 41.
— "Beautiful valley now desolate wasteland," Page 18.
— Sequence of events, page 16
— Map, page 31

MATERIALS:
Map of the zone of devastation.
Transparent grid overlay (each square equals one square mile)

PROCEDURE:
Read the reference articles.

1. Place grid of one-square-miles on map showing area of blast devastation (blowdown area.) Secure the grid with tape so it will not move after you start counting.

2. Count the number of squares of the grid that are completely within the blowdown area. If even the smallest part of the blowdown area lies outside the square, do not count it.
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5. Add your values together. What was the total number of square miles of the blowdown area?

6. How does your value compare to that published in the newspaper? How might this be explained?

7. As it is sometimes difficult to visualize size, let's compare the size to that of a football field. How many football fields do you think would fit inside the blowdown area? (Make a guess).

8. One square mile could contain 516 football fields. Using the approximate value of 500, how many football fields would fit in the blowdown area?

NAME: ______________________________ DATE: ______________

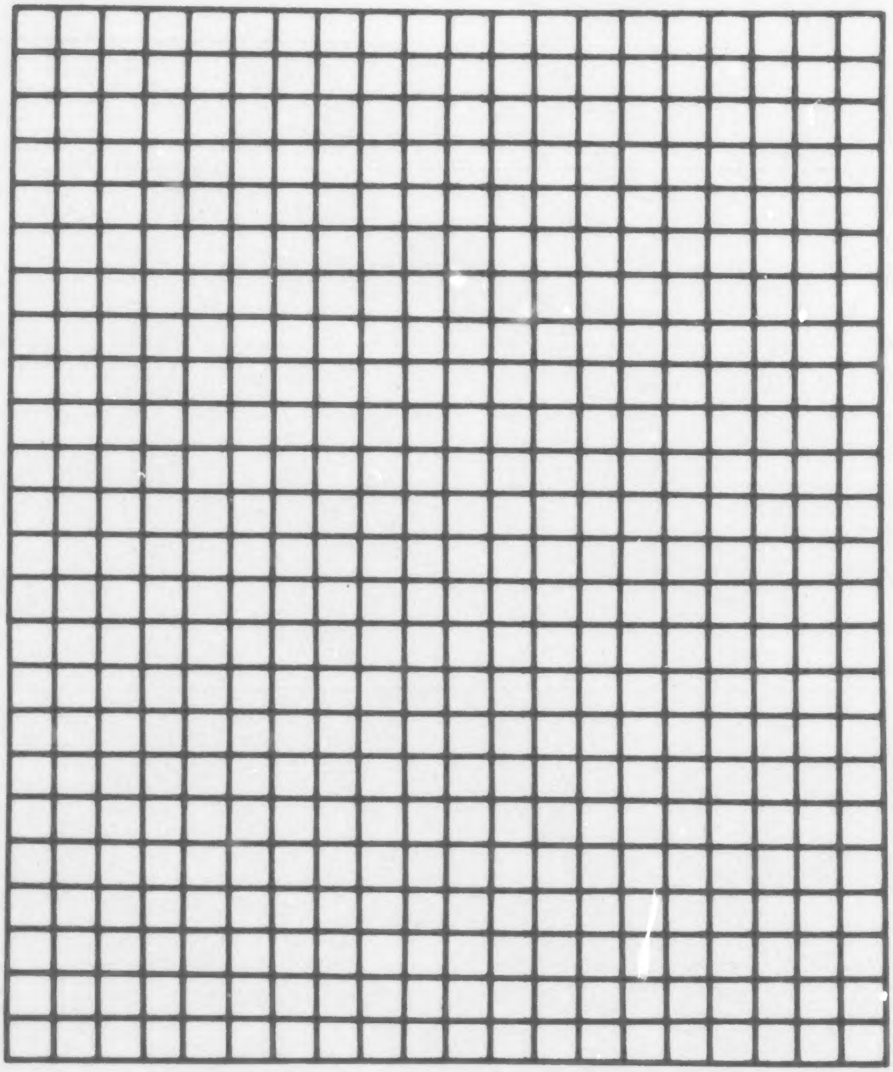
EXTENDED ACTIVITIES

1. If these football fields were laid end-to-end, how far would they stretch in miles? (About 15 football fields laid end-to-end would make up a mile.)

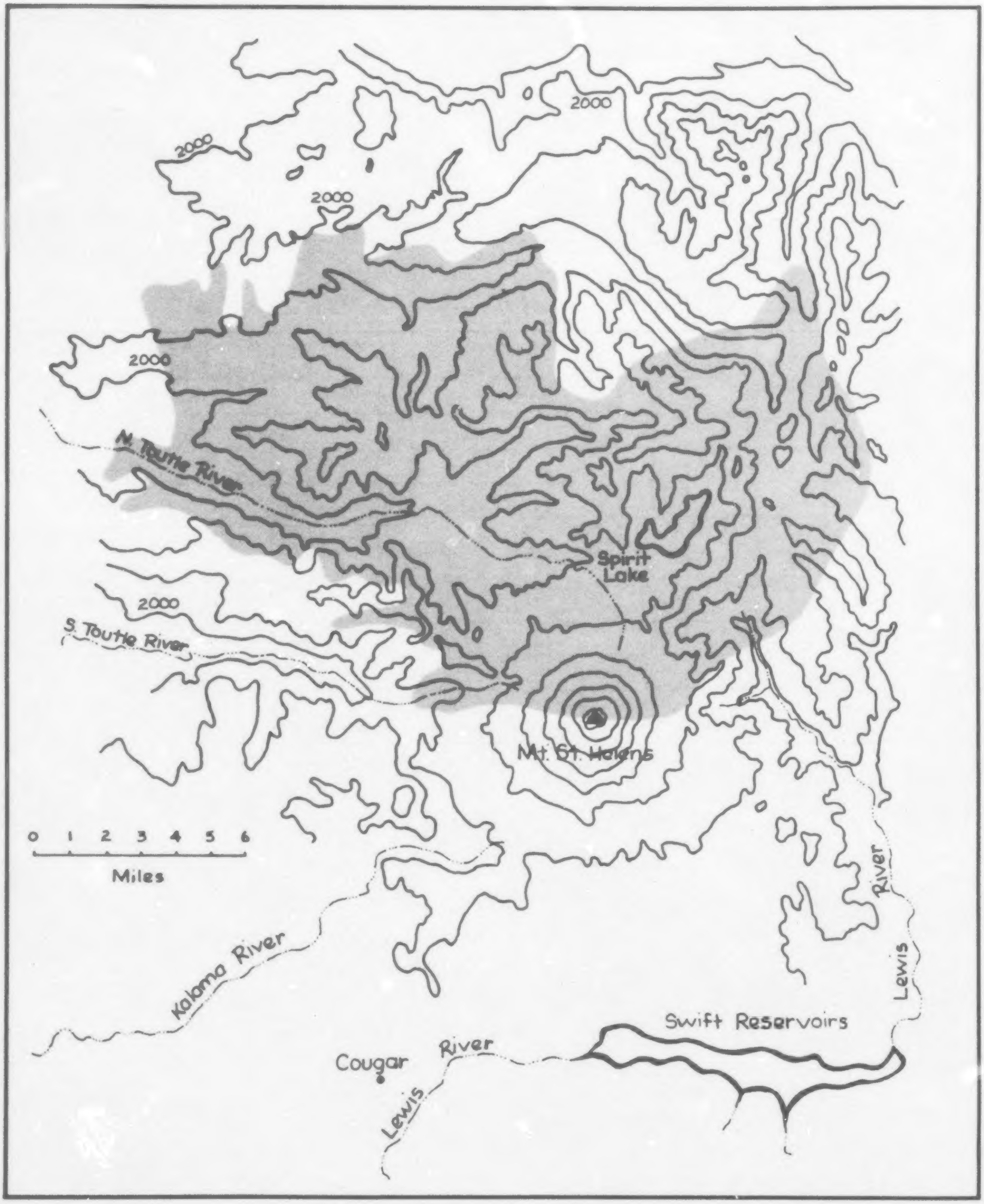
2. How far would this be in terms of the distance between New York City and San Francisco? (This distance is 2,566 miles.)

3. The area of the state of Washington is approximately 68,200 square miles. What precentage of the state does the blowdown area represent?

82



GRID 1/4" – 1 MILE
1 SQUARE – 1 SQUARE MILE


2000
2000
2000
2000
2000
2000
N. Toutle River
S. Toutle River
Spirit Lake
Mt. St. Helens
0 1 2 3 4 5 6
Miles
Kalama River
Cougar
River
Lewis
Swift Reservoirs
River
Lewis

LEVEL INFORMATION: I SCI

CLOUDS WITH ASH DON'T HAVE A SILVER LINING

OBJECTIVE:

The students will answer questions concerning the movement of the ash cloud following the May 18, 1980 eruption of Mount St. Helens.

TEACHER BACKGROUND:

1. The movement of the ash cloud from the May 18 eruption can be traced on satellite photographs. One such photograph is shown on Page 19. You can see how the cloud has spread out. When the photograph was taken at 9:54 a.m., the cloud extended slightly beyond Yakima, Wash. Billows in the cloud suggest that the cloud was formed by continuous eruptions of varying intensity.
2. You will need to provide review and/or information background about:
   - — How to read a.m. and p.m. abbreviations.
   - — Calculating time differences
   - — Reading directions on a map (north, south, east, west)
   - — *How to measure distances on a map
   - — **calculating story problems in math

*Option — do not include question 4
**Option — do not include question 5

TEACHING SUGGESTION:

Tell the students to study the series of drawings on Page 20 of "Mount St. Helens" and answer the questions on the activity sheet.

CLOUDS WITH ASH DON'T HAVE A SILVER LINING

REFERENCE ARTICLES:

- — Drawings, Page 20, movement of ash cloud
- — Photo, boiling clouds, Page 21
- — "Trail of ash cuts gritty pathway across nation," Page 21
- — Weather satellite photo, Page 19

PROCEDURE:

The series of drawings on Page 20 is based on photographs obtained from NOAA. Study these drawings and answer the following questions:

1. The position of the cloud at 8:45 a.m. shows the location of Mount St. Helens. In what direction did winds carry the ash during the next three hours?

East

2. At approximately what time did the ash cloud pass over the state line between Washington and Idaho?

As the cloud was a considerable distance away at 11:15 a.m. and just a short distance over the line at 12:15 p.m., the time can be given as 12:15 p.m. or slightly before 12:15 p.m.

3. The eruption began at 8:32 a.m. How long did it take the ash to travel across the state of Washington?

Something less than 3 hours, 43 minutes.

4. What is the distance between Mount St. Helens and the eastern border of Washington? (Find a map to measure this distance.)

About 400 kilometres (250 miles).

5. If you were in central Washington and saw the cloud of ash approaching from the west, how fast would you have to drive a car eastward to outrun the ash? (Determine the speed of the cloud from your answer to questions 3 and 4. You may use 3½ hours as the time.)

As the cloud was traveling at 114 km/hr or 71 mph, you would have difficulty outrunning the ash cloud.

6. How long did it take the ash cloud to reach New Mexico?

24 hours. It was there by 8:45 a.m. May 19, 1980.

7. What is the difference in the size of the ash clouds between May 18 at 11:15 a.m. and May 19 at 11:15 a.m.?

The area of the cloud on May 18 was much smaller.

8. How can you account for the difference in size?

By the second day, the wind and air currents had dispersed the cloud, so it was tenuous and thin.

NAME: ______________________________ DATE: ______________

CLOUDS WITH ASH DON'T HAVE A SILVER LINING

REFERENCE ARTICLES:
— Drawings, Page 20, movement of ash cloud
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6. How long did it take the ash cloud to reach New Mexico?

7. What is the difference in the size of the ash clouds between May 18 at 11:15 a.m. and May 19 at 11:15 a.m.?

8. How can you account for the difference in size?

LEVEL INFORMATION: SCI/SS P/I

MAPPING THE ASH FALLS

6

OBJECTIVE:
The students will map ash fall of the May 18, May 25 and June 12, 1980, eruptions of Mount St. Helens.

TEACHER BACKGROUND:
Review the articles dealing with distribution of ash.
Much of the information for mapping the May 25 and June 12 eruptions can be found in "Where did all the ash go?" on Page 19.

TEACHING SUGGESTIONS:
Primary: The maps can be done as a class project, and the questions can be discussed in large or small groups.

MAPPING THE ASH FALLS

REFERENCE ARTICLES:
— "Trail of ash cuts gritty pathway across nation," Page 21
— "Where did all the ash go?," Page 19
— Map, Page 26
— Map of May 18 ash fallout, Page 20
— Satellite photo of dust cloud, Page 19
— Prevailing winds map, Page 19
— Map, Page 22

MATERIALS:
Map of United States
Map of Washington
Colored pencil

PROCEDURE:
1. Read the reference articles and maps.
2. Using a colored pencil, draw the outline of the ash fall from the May 18 eruption on the map of the United States.
3. Draw the outline of the ash fall from the May 25 and June 12 eruptions on the map of Washington from the information in the article. Use a different color for each ash fall.

QUESTIONS:
1. Which ash fall covered the largest area?

May 18

2. What Washington city had the greatest amount of ash fall from the May 18 eruption?

Ritzville

3. How do you think the size of the ash falling near the mountain was different from that falling farther away?

The size of the grains closer to the mountain would be much larger than those that fell farther away.

4. What might have happened if the prevailing wind had been blowing from the south?

Seattle may have been hit by ash fall.

5. Why were Longview, Kelso and Vancouver, Wash., regarded as safe areas from the May 18 ash?

The percentages of wind direction toward the west and southwest were so low.

6. What directions did the eruption of May 25, 1980 ash fall?

West and north.

7. What direction did the ash from the eruption of June 12, 1980, fall?

South

EXTENDED ACTIVITY

1. Locate volcanoes along the Cascade Range. Place on a map the locations of the volcanoes.

2. Make a map of Washington showing where the different thicknesses of ash occurred, using the map on Page 26 as a guide.

3. If you live close to Mount St. Helens, contact your local weather service and find out the wind directions for your area during the year. Might Mount St. Helens deliver you some ash via the winds? If so, what would be the best time of year to expect ash?

NAME: ______________________________ DATE: ______________

MAPPING THE ASH FALLS

REFERENCE ARTICLES:
— "Trail of ash cuts gritty pathway across nation," Page 21
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— Map, Page 26
— Map of May 18 ash fallout, Page 20
— Satellite photo of dust cloud, Page 19
— Prevailing winds map, Page 19
— Map, Page 22

MATERIALS:
Map of United States
Map of Washington
Colored pencil

PROCEDURE:

1. Read the reference articles and maps.
2. Using a colored pencil, draw the outline of the ash fall from the May 18 eruption on the map of the United States.
3. Draw the outline of the ash fall from the May 25 and June 12 eruptions on the map of Washington from the information in the article. Use a different color for each ash fall.

QUESTIONS:

1. Which ash fall covered the largest area?

2. What Washington city had the greatest amount of ash fall from the May 18 eruption?

3. How do you think the size of the ash falling near the mountain was different from that falling farther away?

4. What might have happened if the prevailing wind had been blowing from the south?

5. Why were Longview, Kelso and Vancouver, Wash., regarded as safe areas from the May 18 ash?

6. What directions did the eruption of May 25, 1980 ash fall?

7. What direction did the ash from the eruption of June 12, 1980, fall?

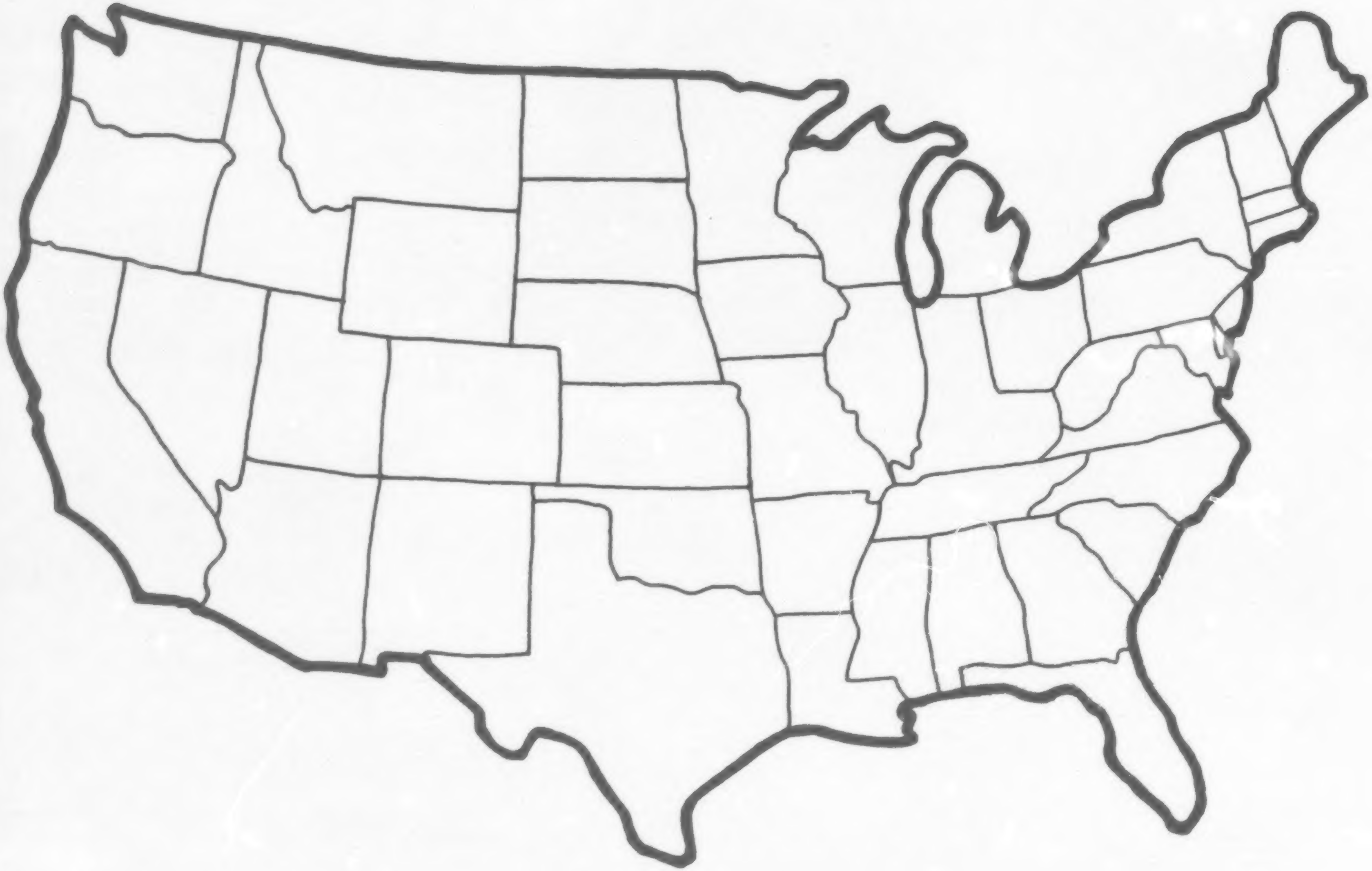
NAME: ______________________________ DATE: ______________

EXTENDED ACTIVITY

1. Locate volcanoes along the Cascade Range. Place on a map the locations of the volcanoes.

2. Make a map of Washington showing where the different thicknesses of ash occurred, using the map on Page 26 as a guide.

3. If you live close to Mount St. Helens, contact your local weather service and find out the wind directions for your area during the year. Might Mount St. Helens deliver you some ash via the winds? If so, what would be the best time of year to expect ash?



LEVEL INFORMATION: SCI/SS P/I

BLAST AWAY!

OBJECTIVES:

The students will:

1. Compare the amount of displaced material in the Mount St. Helens eruption with other eruptions throughout history.

2. Produce graphs about the displaced material.

3. Compare the size of the eruption with human loss.

TEACHING SUGGESTIONS:

1. Read the reference article to your class (or have someone in the class read it.)

2. Using activity sheet I, tell the students to fill in the amount of human loss due to volcanic activity. Be sure to ask them why nothing can be filled in for Mount Skaptar.

3. Primary teachers may wish to include addition and subtraction questions in the activities.

4. Before starting Activity III, locate or ask the students to locate Tambora, Krakatoa, Pelee and Mount St. Helens on a map. Ask why Tambora and Krakatoa are alike. Tell them to find St. Pierre on an old map. They should observe its proximity to the volcano.

BLAST AWAY!
ACTIVITY I — RECORDING HUMAN LOSS

REFERENCE ARTICLES:

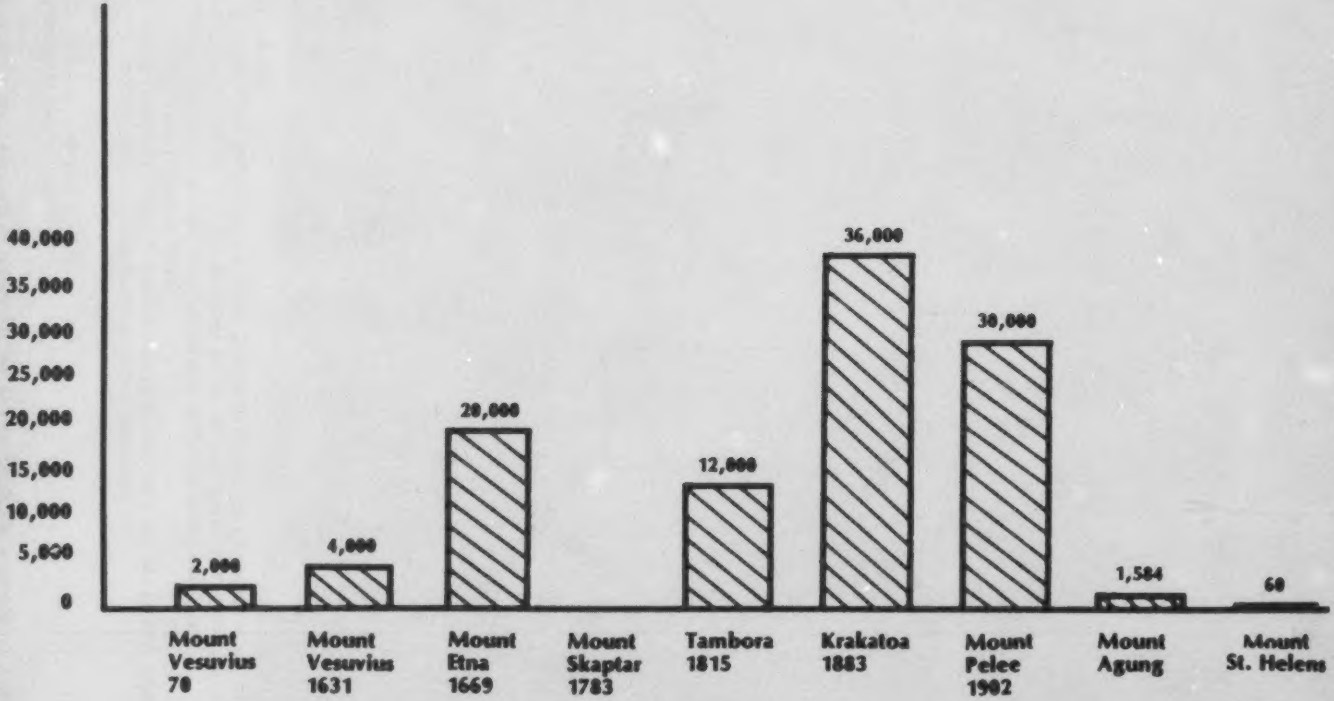
— "Eruptions in past have killed many," p. 36

PROCEDURE:

1. After reading the article "Eruptions in past have killed many," put the number of people killed by each eruption in the space provided.

Mount Vesuvius	AD 79	**2,000**
Mount Vesuvius	1631	**4,000**
Mount Etna	1669	**20,000**
Mount Skaptar	1783	**--,---**
Tambora	1815	**12,000**
Krakatoa	1883	**36,000**
Mount Pelee	1902	**30,000**
Mount Agung	1963	**1,584**
Mount St. Helens	1980	**60**

2. Construct a bar graph, using activity sheet I to record the deaths.



ACTIVITY SHEET I

ACTIVITY II — DISPLACED MATERIAL

1. The amount of material that comes out of a volcano is called "displaced material." Some volcanoes erupt more material than others. Mount St. Helens lost about one square kilometre of material. This material took the form of hot rock and ash which would make a road 10 m wide and 10 cm thick that would go around the world over 32 times.

2. Notice the difference in amounts of material lost by volcanoes shown below.
   a. Which volcano lost the most?

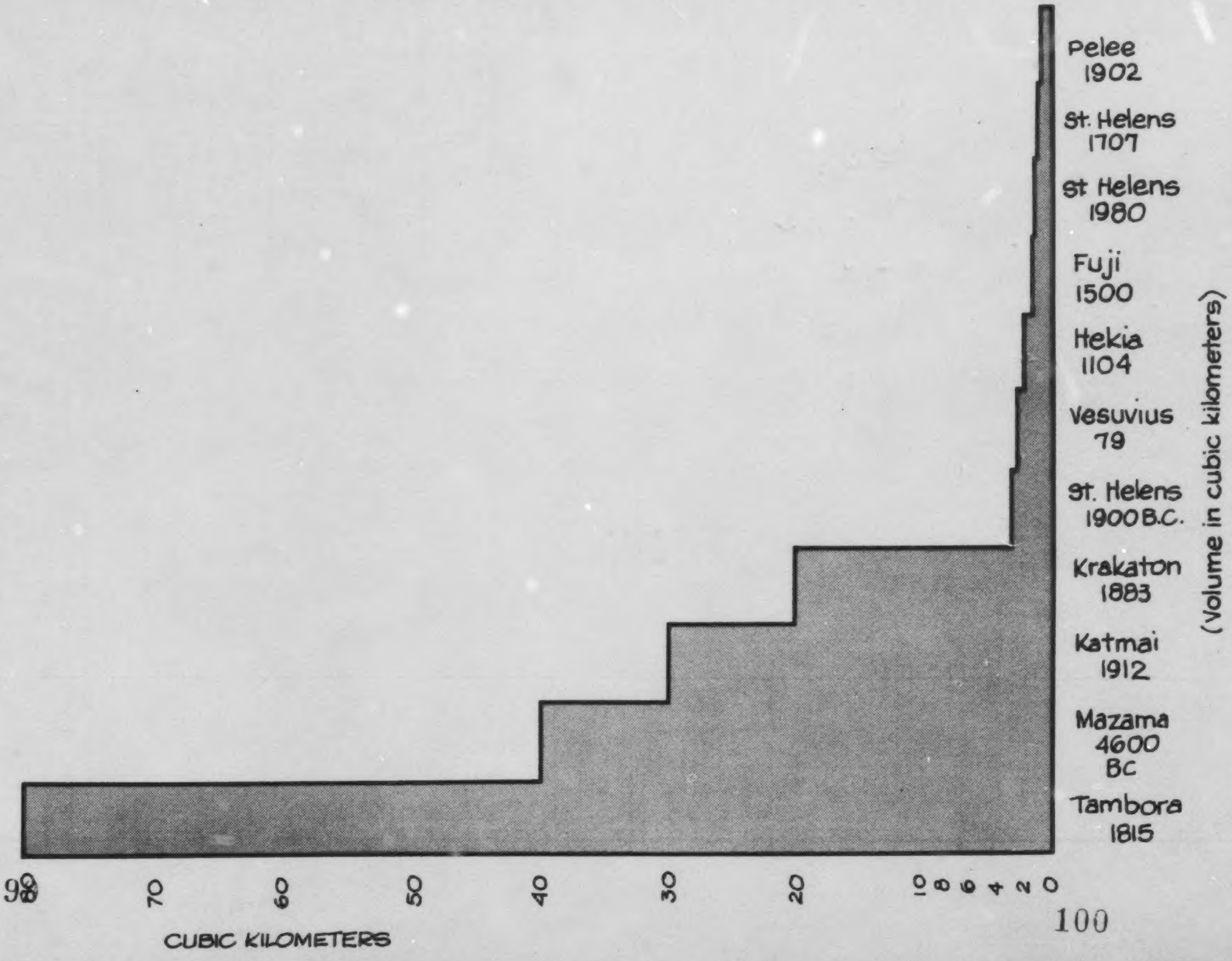
Tambora

   b. Which volcano lost the least?

Pelee

3. Make a bar graph of the displaced material on the activity II worksheet.

VOLCANO (DATE)	DISPLACED MATERIAL Volume in cubic kilometres
Mazama (4600 BC)	40
St. Helens (1900 BC)	3.3
Vesuvius (79)	2.7
Hekla (1104)	2.0
Fuji (1500)	1.3
St. Helens (1707)	0.9
Tambora (1815)	80
Krakatoa (1883)	20
Pelee (1902)	0.3
Katmai (1912)	30
St. Helens (1980)	1.0


Pelee 1902
St. Helens 1707
St Helens 1980
Fuji 1500
Hekia 1104
Vesuvius 79
St. Helens 1900 B.C.
Krakaton 1883
Katmai 1912
Mazama 4600 BC
Tambora 1815
(Volume in cubic kilometers)
80
70
60
50
40
30
20
10
8
6
4
2
0
CUBIC KILOMETERS

ACTIVITY III — COMBINATION OF MATERIAL DISPLACED AND HUMAN LOSS

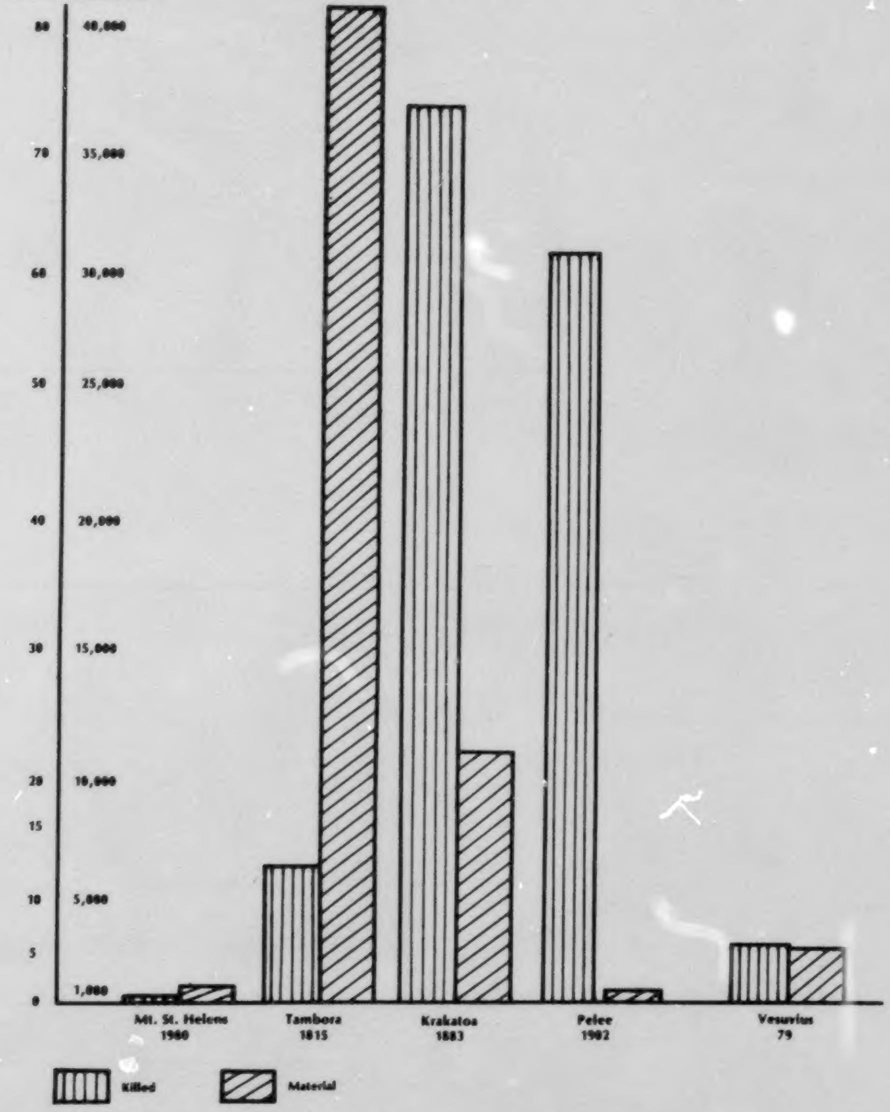
Some of the volcanoes have a record of the number of people killed and amount of displaced material erupted. They are Tambora, Krakatoa, Pelee and the Vesuvius eruption of 79 A.D.

1. In the table below, fill in the number of people killed and amount of displaced material for each volcano.

Volcano	Death toll	Displaced material
Vesuvius	2,000	2.7
Tambora	12,000	80
Krakatoa	36,000	20
Pelee	30,000	0.3
St. Helens	60	1.0

2. Make one more bar graph. This time, plot both the people killed and displaced material side by side on activity sheet III. St. Helens is done for you. Use either the shading used in the example or two different colors of crayon or pen.

ACTIVITY SHEET III



1. As you study the graph on activity sheet III, does it appear that the bigger the eruption, the more people will be killed? Which volcanoes make you think so, and why?

Pelee. It has the smallest displaced material, but second greatest casualty figure. And Mount St. Helens has a displaced rate greater than Pelee but has the fewest killed.

2. Tambora and Krakatoa are both islands. Yet Tambora had far fewer deaths. What are some possible explanations?

Krakatoa was a stronger eruption. More people may have lived on Krakatoa. More people may have lived closer to the volcano.

3. Krakatoa and Pelee killed almost the same number of people, even though Pelee's eruption was not nearly as strong. Why were so many killed by Pelee?

The city of St. Pierre was very close.

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EXTENDED ACTIVITY

MATERIALS:
Protractor

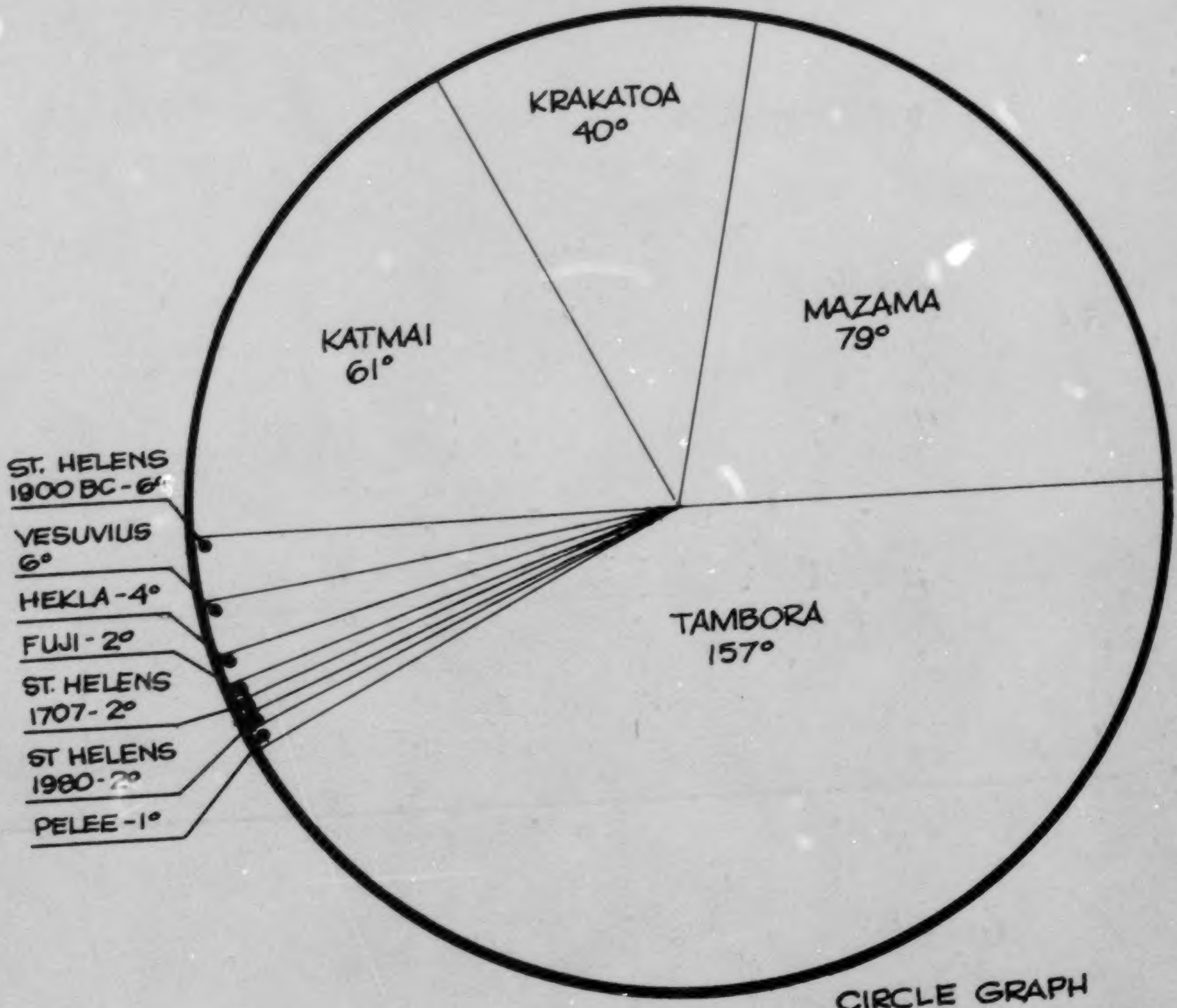
PROCEDURE:

1. Using the information in the chart "Volume of Volcano Displacement" activity sheet II, use the protractor to construct a circle graph to determine the location of the pie-shaped sections on the graph. Do not try to make the smaller amounts perfect. (Suggestions: Your measurements should be based on the degrees of circle.)

VOLUME OF VOLCANO DISPLACEMENT

(Total Displaced Volume of All Volcanoes + 180.3 cubic km.)

Volcano	Percent of Total	Degrees of Circle
Mazama	22	79 decrees
St. Helens 1900 B.C.	1.7	6 degrees
Vesuvius	1.5	6 degrees
Hekla	1.1	4 degrees
Fuji	.7	2 degrees
St. Helens 1707	.5	2 degrees
Tambora	44	157 degrees
Krakatoa	11	40 degrees
Pelee	.2	1 degree
Katmai	17	61 degrees
St. Helens 1980	.6	2 degrees



CIRCLE GRAPH

EXTENDED ACTIVITY — VOLCANIC HIGHWAY

MATERIALS:
Pencil and paper

PROCEDURE:
Answer the questions below. Base your answers on the following information:
1 cubic kilometre was ejected by Mount St. Helens in 1980. (1 cubic kilometre 1,000m X 1,000m X 1,000m)

QUESTIONS:

1. If you used the material ejected in 1980 from Mount St. Helens to build a road 10m wide by 10cm thick, how long would the road be?

1 cubic kilometre	**1,000m X 1,000m X 1,000m**
	1,000,000,000 cubic metres
Road section	**1 kilometre X 10m X 10cm**
	1,000m X 10m X .1m
	1,000 cubic m/cm
Total length	**1,000,000,000 cubic metres**
	1,000 cubic m/cm
	1,000,000 kilometres

2. How long would the same road be if the material ejected by Mount Tambora was used?

Since Tambora blew out 80 times as much material as Mount St. Helens the road would be 80,000,000 kilometres long.

3. Compare this to the distance from Seattle to Washington D.C.

Seattle to Washington, D.C., is 3,615.87km.

St. Helens road is 1,000,000 km.

St. Helens road is 276 times as long (276.56).

NAME: ______________________________ DATE: ______________

BLAST AWAY!
ACTIVITY I — RECORDING HUMAN LOSS

REFERENCE ARTICLES:

— **"Eruptions in past have killed many," p. 36**

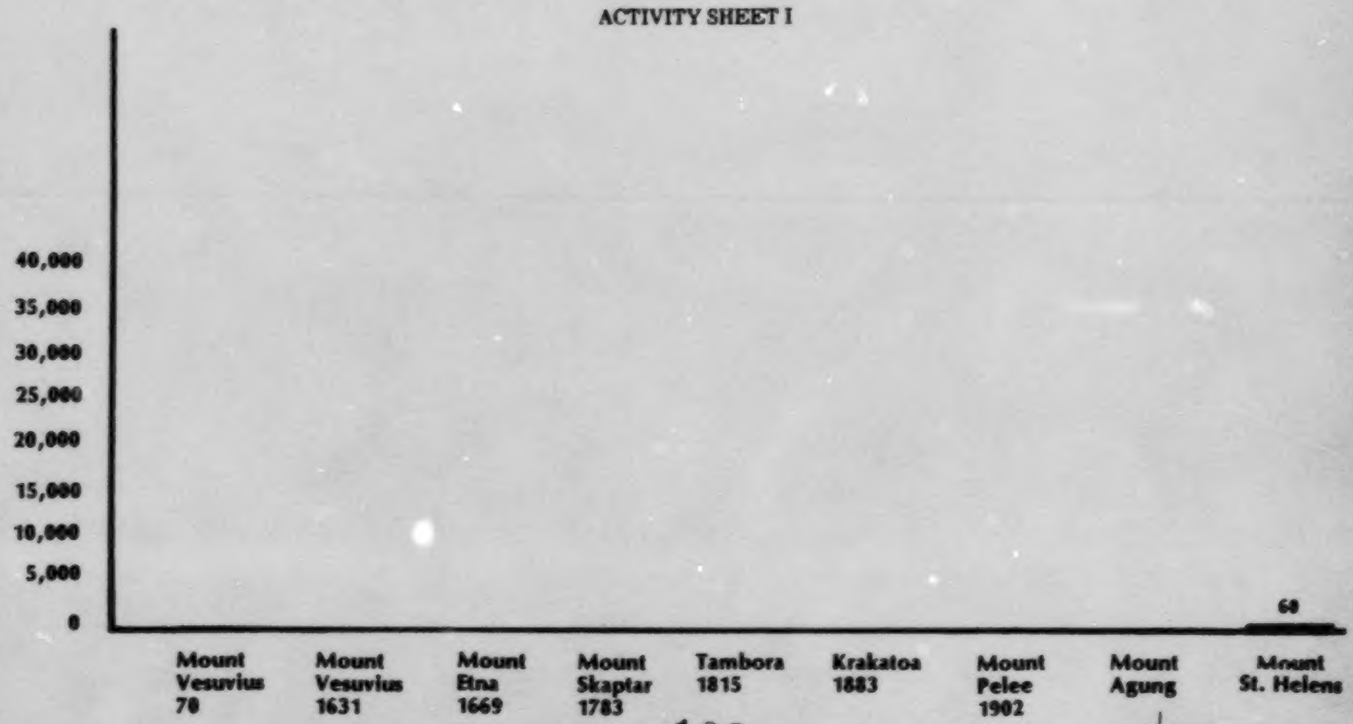
PROCEDURE:

1. After reading the article "Eruptions in past have killed many," put the number of people killed by each eruption in the space provided. Use 60 for the approximate number of people killed in the eruption of Mount St. Helens.

Mount Vesuvius	**AD 79**	____________
Mount Vesuvius	**1631**	____________
Mount Etna	**1669**	____________
Mount Skaptar	**1783**	____________
Tambora	**1815**	____________
Krakatoa	**1883**	____________
Mount Pelee	**1902**	____________
Mount Agung	**1963**	____________
Mount St. Helens	**1980**	____________

2. Construct a bar graph, using activity sheet 1, to show the number of deaths.

ACTIVITY SHEET I



NAME: ______________________________ DATE: ______________

ACTIVITY II — DISPLACED MATERIAL

1. The amount of material that comes out of a volcano is called "displaced material." Some volcanoes erupt more material than others. Mount St. Helens lost about one square kilometre of material. This material took the form of hot rock and ash which would make a road 10 m wide and 10 cm thick that would go around the world over 32 times.

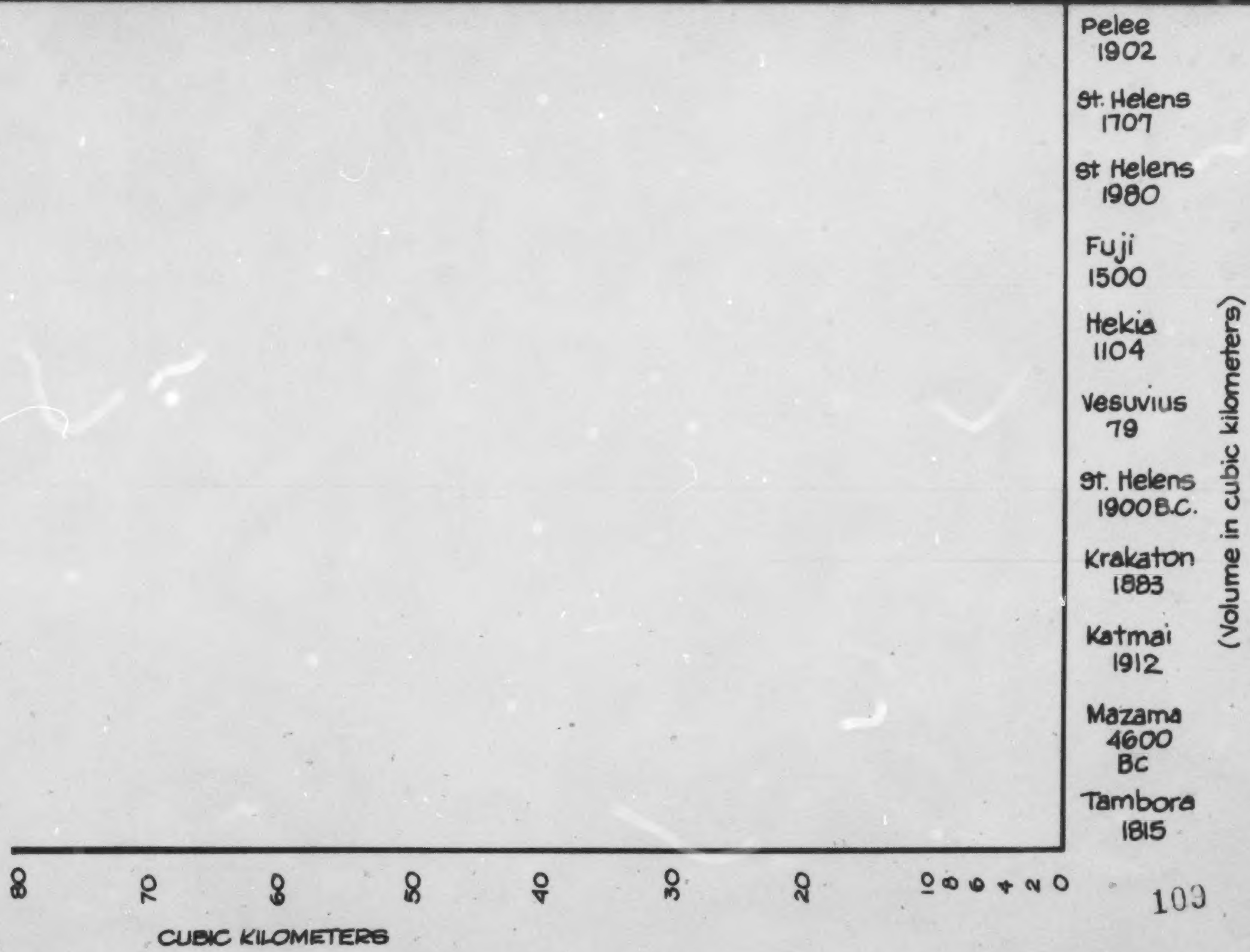
2. Notice the difference in amounts of material lost by volcanoes shown below.
   a. Which volcano lost the most?

   b. Which volcano lost the least?

3. Make a bar graph of the displaced material on the activity II worksheet.

VOLCANO (DATE)	DISPLACED MATERIAL Volume in cubic kilometres
Mazama (4600 BC)	40
St. Helens (1900 BC)	3.3
Vesuvius (79)	2.7
Hekla (1104)	2.0
Fuji (1500)	1.3
St. Helens (1707)	0.9
Tambora (1815)	80
Krakatoa (1883)	20
Pelee (1902)	0.3
Katmai (1912)	30
St. Helens (1980)	1.0

ACTIVITY SHEET II



NAME: ______________________________ DATE: ______________

ACTIVITY III — COMBINATION OF MATERIAL DISPLACED AND HUMAN LOSS

Some of the volcanoes have a record of the number of people killed and amount of displaced material erupted. They are Tambora, Krakatoa, Pelee and the Vesuvius eruption of 79 A.D.

1. In the table below, fill in the number of people killed and amount of displaced material for each volcano.

Volcano	Death toll	Displaced material
Vesuvius		
Tambora		
Krakatoa		
Pelee		
St. Helens		

2. Make one more bar graph. This time, plot both the people killed and displaced material side by side on activity sheet III. St. Helens is done for you. Use either the shading used in the example or two different colors of crayon or pen.

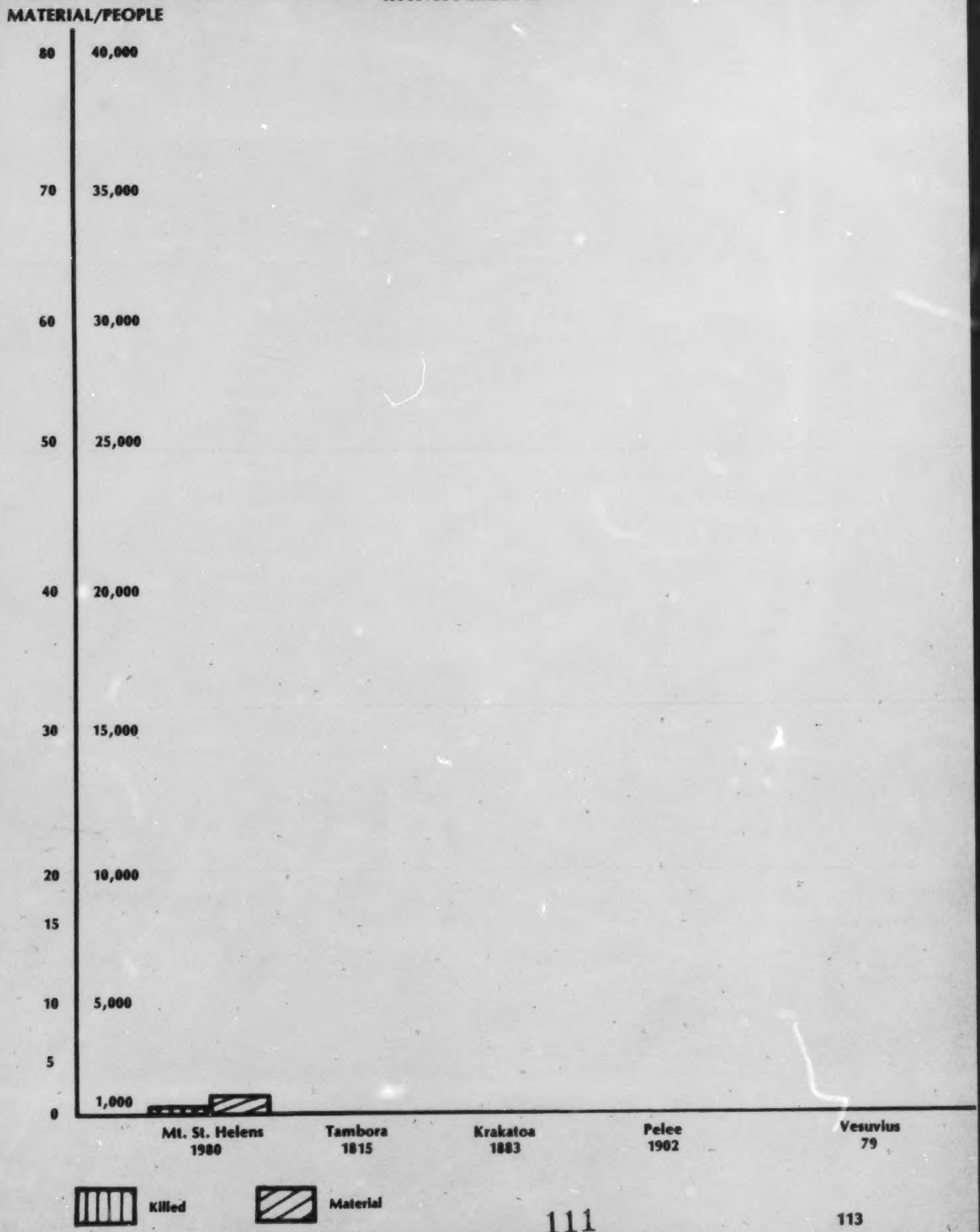
QUESTIONS:

1. As you study the graph on activity sheet III, does it appear that the bigger the eruption, the more people were killed? Which volcanoes make you think so, and why?

2. Tambora and Krakatoa are both islands. Yet Tambora had far fewer deaths. What are some possible explanations?

3. Krakatoa and Pelee killed almost the same number of people, even though Pelee's eruption was not nearly as strong. Why were so many killed by Pelee?

ACTIVITY SHEET III



NAME: ______________________________ DATE: ______________

EXTENDED ACTIVITY

MATERIALS:
Protractor

PROCEDURE:

1. Using the information in the chart "Volume of Volcano Displacement" activity sheet II, use the protractor to construct a circle graph to determine the location of the pie-shaped sections on the graph. Do not try to make the smaller amounts perfect. (Suggestions: Your measurements should be based on the degrees of circle.)

VOLUME OF VOLCANO DISPLACEMENT
Total Displaced Volume of All Volcanoes+ 180.3 cubic km.

Volcano	Percent of Total	Degrees of Circle
Mazama	22	79 degrees
St. Helens 1900 B.C.	1.7	6 degrees
Vesuvius	1.5	6 degrees
Hekla	1.1	4 degrees
Fuji	.7	2 degrees
St. Helens 1707	.5	2 degrees
Tambora	44	157 degrees
Krakatoa	11 percent	40 degrees
Pelee	.2	1 degree
Katmai	17	61 degrees
St. Helens 1980	.6	2 degrees

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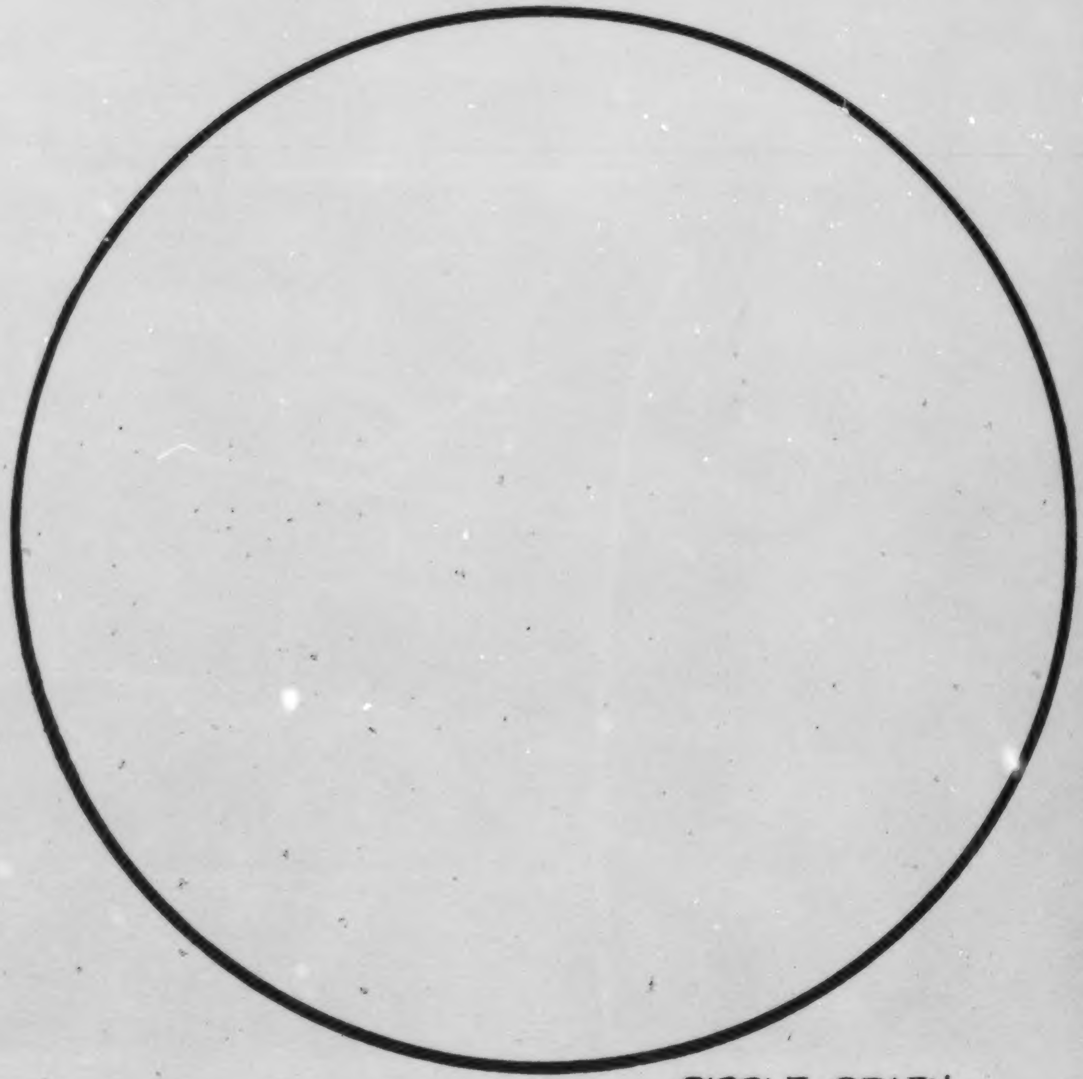

CIRCLE GRAPH

NAME: ______________________________ DATE: ______________

EXTENDED ACTIVITY — VOLCANIC HIGHWAY

MATERIALS:
Pencil and paper

PROCEDURE:

Answer the questions below. Base your answers on the following information:

1 cubic kilometre was ejected by Mount St. Helens in 1980. (1 cubic kilometre 1,000m X 1,000m X 1,000m)

QUESTIONS:

1. If you used the material ejected in 1980 by Mount St. Helens to construct a road 10m wide by 10cm thick, how long would the road be?

2. How long would the same road be if the material ejected by Mount Tambora was used?

3. Compare this to the distance from Seattle to Washington D.C.

LEVEL INFORMATION: SCI/LA P/I

DESCRIPTIVE STORY BASED ON PICTURES

OBJECTIVE:

The students will dictate to a teacher or aide a descriptive story based on pictures and articles chosen from the "Mount St. Helens" student tabloid.

TEACHING SUGGESTIONS:

1. Have the students, as a class, select one or two pictures and two or three related articles from the Student Tabloid.
2. Read the articles to the class or ask someone to read them to the class.
3. Using those references, have students list all the words the articles and pictures make them think of. Write the words on a chalkboard, butcher paper or chart. (The teacher or aide can do this.)
4. Ask the students to describe what type of story they would like to write (scary, funny, serious).
5. Tell each student to make up one sentence about the pictures and articles using the words from their list.
6. Ask each student to dictate part of a story to the teacher or aide about the pictures or articles. Use the sentences and words as a starting point. Record the story on a chalkboard, butcher paper or chart.
7. As students dictate their parts be sure to help them relate structure, plot and style to the story. This can be done by:
   a. Rereading story aloud several times as writing is being done.
   b. Questioning students as to the "sense" and organization of their sentences and perhaps helping them reword.
8. The finished story can be displayed with the pictures and articles. Specific students can be asked to reread it aloud for several days.

EXTENDED ACTIVITIES:

1. Have students follow the same procedure as individuals and then read their stories aloud to others.
2. Some students may want to write their own stories once the class has worked together on format and style and the common story.

LEVEL INFORMATION: SCI P/I

AND THEN, SHE WENT POP!

OBJECTIVES:
The students will:
1. Observe the action of soda and vinegar in a closed container.
2. Hypothesize about the effects of varying the amount of baking soda.

TEACHER BACKGROUND:
1. This should only be done as a demonstration because of the safety factor. Flying corks can and do go astray.
2. The product of soda and vinegar is a gas, carbon dioxide, similar to that found in pop.

TEACHING SUGGESTIONS:
Materials:
Four test tubes
Cork or solid rubber stoppers
Baking soda
Vinegar
Cup (paper)
Plastic spoons (all the same size)
Measuring cup

DEMONSTRATION 1

1. Clean a test tube and cork for this experiment.
2. Place a spoonful of baking soda in the test tube.
3. Add 2 ounces of vinegar to the tube.
4. Quickly, replace the cork lightly over the end of the test tube.
5. Point the tube away from the students.

DEMONSTRATION 2

1. Follow the directions for Demonstration 1, only increase the baking soda to two spoonfuls.

DEMONSTRATION 3

1. Follow the directions for demonstration 1, only decrease the baking soda to ½ spoonful.

DEMONSTRATION 4

1. Follow directions for demonstration 1.
2. Repeat the demonstration, using water in place of vinegar.
3. Compare the amount of material left in the tube after each demonstration.

AND THEN, SHE WENT POP!

REFERENCE ARTICLES:
— "Nature uncorked a very powerful bottle," Page 18
— "Predictions more accurate as time goes on," Page 6

PROCEDURE:
1. Observe the teacher's demonstration.
2. Write possible answers to the questions below; or:
3. Participate in classroom discussion on the questions below.

DEMONSTRATION 1

QUESTIONS:

1. Describe what happened inside the test tube after the vinegar was added.

Answers will vary

2. When the vinegar was added, the cork should have popped out. Why did this happen or not happen?

Because of expanding gases much like those which expanded in Mount St. Helens.

3. Make a prediction about what will happen if the amount of soda is increased from 1 spoonful to 2 spoonfuls.

The cork will probably come out sooner and go farther.

a. Why did you make this prediction?

More soda will produce more gas when mixed with the vinegar.

4. What would happen if you waited one minute to put the cork on the tube? Why?

Nothing, because the reaction is very rapid, and after one minute, it would be over.

DEMONSTRATION 2

1. What happened inside the test tube?

Answers will vary.

2. Were there any differences from demonstration 1? If so list them below.

Answers will vary

3. Make another prediction. What will happen if half as much baking soda is placed in the test tube? (1 spoonful to ½ a spoonful)

The cork will not pop out as far or as quickly.

a. Why did you make this prediction?

Because less gas would be generated the second time, placing less pressure on the liquid in the tube and the cork.

DEMONSTRATION 3

1. What happened inside the tube after the vinegar was added?

Answers will vary

2. What were the differences from the other two demonstrations?

Answers will vary

3. What can you say about the amount of baking soda in vinegar and the cork popping?

The more soda, the more force produced.

4. Read "Nature uncorked a very powerful bottle." How is this demonstration like a volcano?

You may choose to read this article to the class and use this question for discussion.

5. The cork blew out because of an increase in the pressure. What caused this increase in the pop bottle when the soda and vinegar were added?

Gas (CO_2) was produced.

6. a. The same gas in the pop bottle is also produced by Mount St. Helens. The gas is called CO_2 or carbon dioxide. Read the last two columns of "Predictions more accurate as time goes on," Page 6, to find out what this gas does before an eruption.

The amount of gas produced decreases dramatically, 15,000 to 4,000 tons daily.

b. Why does the pressure increase in the volcano, according to this article?

The pressure increases because the volcano becomes ''sealed,'' like the cork sealing the bottle.

DEMONSTRATION 4

1. Which test tubes had the least material after a demonstration?

Soda and vinegar tube

2. Why did the cork pop off the test tube with vinegar, but not the test tube with water?

No gas produced with water

3. Why do you think there was a difference in the amount of material in the vinegar and soda tube?

Part of the soda and vinegar turned into gas

EXTENDED ACTIVITY

1. Name instruments used to measure activity on Mount St. Helens. Make a class chart showing the name of the instrument, what it does and, if possible, a picture or drawing.

NAME: ______________________________ DATE: ______________

AND THEN, SHE WENT POP!

REFERENCE ARTICLES:
— "Nature uncorked a very powerful bottle," Page 18
— "Predictions more accurate as time goes on," Page 6

PROCEDURE:
1. Observe the teacher's demonstration.
2. Write possible answers to the questions below; or:
3. Participate in classroom discussion on the questions below.

DEMONSTRATION 1

QUESTIONS:
1. Describe what happened inside the test tube after the vinegar was added.

2. When the vinegar was added, the cork should have popped out. Why did this happen or not happen?

3. Make a prediction about what will happen if the amount of soda is increased from 1 spoonful to 2 spoonfuls.

   a. Why did you make this prediction?

4. What would happen if you waited one minute to put the cork on the tube? Why?

DEMONSTRATION 2

1. What happened inside the test tube?

2. Were there any differences from demonstration 1? If so list them below.

3. Make another prediction.
What will happen if half as much baking soda is placed in the test tube? (1 spoonful to ½ a spoonful)

   a. Why did you make this prediction?

DEMONSTRATION 3

1. What happened inside the tube after the vinegar was added?

2. What were the differences from the other two demonstrations?

3. What can you say about the amount of baking soda in vinegar and the cork popping?

4. Read "Nature uncorked a very powerful bottle." How is this demonstration like a volcano?

5. The cork blew out because of an increase in the pressure. What caused this increase in the pop bottle when the soda and vinegar were added?

6. a. The same gas in the pop bottle is also produced by Mount St. Helens. The gas is called CO_2 or carbon dioxide. Read the last two columns of "Predictions more accurate as time goes on," Page 6, to find out what this gas does before an eruption.

b. Why does the pressure increase in the volcano, according to this article?

DEMONSTRATION 4

1. Which test tubes had the least material after a demonstration?

2. Why did the cork pop off the test tube with vinegar, but not the test tube with water?

3. Why do you think there was a difference in the amount of material in the vinegar and soda tube?

EXTENDED ACTIVITY

Name instruments used to measure activity on Mount St. Helens. Make a class chart showing the name of the instrument, what it does and, if possible, a picture or drawing.

LEVEL INFORMATION: SS/SCI P/I

ASH MASK EFFECTIVENESS

OBJECTIVE:
The students will describe different types of ash masks and their effectiveness.

TEACHING SUGGESTIONS:
1. **Have students read the reference articles.**
2. **Discuss various types of masks and their effectiveness with the class.**
3. **Bring in materials and have students make ash masks.**

ASH MASK EFFECTIVENESS

REFERENCE ARTICLES:
- — "Worker safety topic of ash investigation," Page 22.
- — "Lung problems up at Moses Lake," Page 24.
- — "Dust driving longtime Cougar residents out," Page 21.
- — "Health . . .," Page 22
- — "Scientists study effects of ash closely," Page 19

ACTIVITY I — ASH MASKS

Read the reference articles and answer the following questions.

1. Why are some fabrics better for making face masks than others?

Because of the coarseness of the material. Fine weaves of material will filter out materials more effectively.

2. Would wearing two masks be better than wearing one? Why?

Yes. The material getting through the first mask may be filtered out by the second. It is very important not to hamper breathing, however.

3. What could you use as a mask if ash started to fall right this minute?

Something you are wearing or have with you

ACTIVITY II — EFFECTIVENESS OF ASH MASKS

1. Bring in various types of material and construct ash masks.

2. Order the masks or material swatches for their effectiveness. To determine the effectiveness, pour a mixture of soil or ash and water through each mask. The same amount of water should be poured into each mask. Catch the filtered water in a clear container. The clearest water is the best filtered. Order the filtered water, No. 1 being clearest. Be sure you keep the fabric with the container of water.

3. Attach pieces of fabric below.

No. 1	No. 2	No. 3	No. 4

A large jar of soil or ash and water would ensure the same soil concentration being used each time.

4. Pretend you are going to make ash masks for a living. You can buy 10 yards of fabric No. 1 for $10.00. You can buy 10 yards of fabric No. 4 for $5.00. To break even with fabric No. 1, you will need to charge $1.00 per mask, for fabric No. 4, 60 cents.

Which fabric would you choose to use? Why?

Answers will vary

NAME: ______________________________ DATE: ______________

ASH MASK EFFECTIVENESS

REFERENCE ARTICLES:
- "Worker safety topic of ash investigation," Page 22.
- "Lung problems up at Moses Lake," Page 24.
- "Dust driving longtime Cougar residents out," Page 21.
- "Health . . .," Page 22
- "Scientists study effects of ash closely," Page 19

ACTIVITY I — ASH MASKS

Read the reference articles and answer the following questions.

1. Why are some fabrics better for making face masks than others?

2. Would wearing two masks be better than wearing one? Why?

3. What could you use as a mask if ash started to fall right this minute?

NAME:____ **DATE:**________________

ACTIVITY II — EFFECTIVENESS OF ASH MASKS

1. Bring in various types of material and construct ash masks.

2. Order the masks or material swatches for their effectiveness. To determine the effectiveness, pour a mixture of soil or ash and water through each mask. The same amount of water should be poured into each mask. Catch the filtered water in a clear container. The clearest water is the best filtered. Order the filtered water, No. 1 being clearest. Be sure you keep the fabric with the container of water.

3. Attach pieces of fabric below.

No. 1 No. 2 No. 3 No. 4

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Which fabric would you choose to use? Why?

LEVEL INFORMATION: SCI P/I

WHAT'S INSIDE A VOLCANO?

OBJECTIVES:

Using cross-section diagrams, the students will:

1. Correctly color and label parts of a volcano.
2. Identify friction between rocky plates as the source of some earthquakes and of heat that melts rocks to make magma.
3. State two scientific opinions about the bulge that preceded the May 18 eruption of Mount St. Helens.
4. State the basic distinction between real volcanic eruptions and fumaroles (steam vents).
5. State which elements in a volcanic cross-section are observable and which are inferred.
6. Make several predictions about the volcano's future activity based on different conditions within the volcano.

MATERIALS:

Overhead transparencies. 1 of diagrams 1, 2 and 4; 2 of diagram 3
Several (10 at most) blank transparencies
Dittoes — 1 per pupil of each diagram (cross-section) except No. 2
Red, black and blue transparency pen for teacher
Blocks of lumber, such as 2 x 20 or 4 x 45 — about 12 inches long
Handful of sand or dirt
Rounded pebble — about 1 inch in diameter (not a marble — the pebble will rock, but not roll)

TEACHER BACKGROUND:

A. Students need to know:

1. What a cross-section is. This can be demonstrated quickly with a piece of fruit, or a two layer ball of plasticene, and a knife. (Pupils could demonstrate understanding by drawing a cross-section of a banana).
2. That rock can be melted if it's hot enough. If your pupils have made ceramic items, remind them that the kiln must be turned off before it gets so hot that it melts the pots.
3. The meaning of the word "friction."

B. Current idea or theory is that magma is created under some volcanoes by the heat of friction where one plate of the earth's crust overrides another. See article headlined "Plate Theory Links St. Helens, Red Sea, Antarctica in the Teacher Edition, Appendix III. The accompanying diagrams will be helpful.

TEACHING SUGGESTIONS:

Discuss these areas with your students.

1. Discussion Question: What's inside a volcano?

   a. Primary pupils only: draw what they think a cross-section of a volcano way down into the earth would look like. Post with some such caption as "What I thought first." Post later pictures with caption such as "What I learned."

   b. Distribute dittoes of diagram 1. Use transparency. Be sure pupils know rock can become red-hot and can melt. Color magma chambers red; students do the same on their dittoes. Color the rest of the plug black.

   c. On diagram 2 write words one at a time for pupils to copy, discussing each. Omit North American Plate and Pacific Plate. Collect the dittoes for use with Question 2 unless you plan to do both in one sitting.

2. Discussion Question: Why is the rock so hot right under the volcano?

   a. Rub hands together hard and fast — note heat.

   b. Recall method of starting fire by rubbing sticks together. After discussing a. and b., mention that many scientists believe that friction between rocks rubbing across each other miles below the surface melts the rocks.

   c. Hand back pupils' dittoes from question 1 if they have been collected. Call attention to the arrows on the transparency of diagram 1 showing directions of motion of the North American Plate and Pacific Plate. State that scientists believe there are two layers of rock many miles (kilometres) under our feet moving in opposite directions. The friction produces heat that melts the rocks to make magma, and also causes some of our earthquakes. Label these two plates on the diagram and have the students label their dittoes. Note: It may be more convenient for you to replace the transparency from diagram 1 with the transparency from diagram 2.

3. Discussion Question: What's the connection between volcanoes and earthquakes?

   a. Demonstrate earthquake activity by rubbing one piece of lumber over the other with sand or dirt between and rounded pebble on top. Explain that the activity of the pebble is the shaking that we feel on the surface.

   b. Review information from Question 2 that the friction can melt those grinding rocks. Therefore, earthquakes might signal enough friction to melt the rocks, which in turn could result in an eruption.

4. Discussion Question: What warning besides earthquakes do some volcanoes give that they're going to explode?

   a. Refer the students to "Mount St. Helens" article "Quiet Broken by New Eruption," Page 11.

   b. Use transparencies made from diagram 3.

   c. Ask students to notice the bulge on the north side of the mountain.

   d. Tell the students to find two ideas in the article about the cause of the bulge. The answer is in paragraph 2.

   e. Tell students to write their answers on the question ditto.

   f. While pupils are searching, start coloring the magma red on the transparency. Discuss with the students the two ways they might fill in the bulge in the tube — rocks (black) or magma (red).

   g. Color one transparency according to each theory. The rocks should be depicted broken up, as in the top of the neck in the diagram.

5. Discussion question: What's the difference between a real volcanic eruption and steam venting?

   a. Ask the students: What happens when you drop water on something very hot? (Answer: sizzles, makes a cloud)

   (Review diagram 3 transparency used in question 4 to show where this happens.) With magma up so high in the tube, the rocks are very hot.

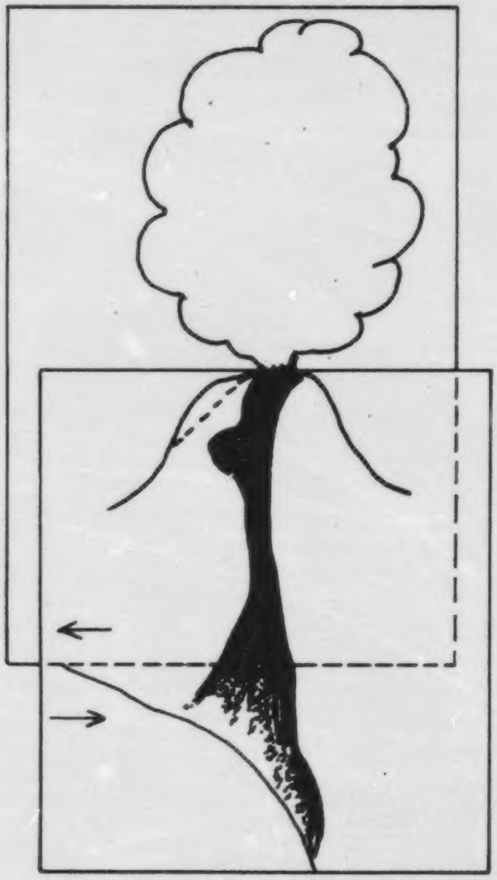
b. Ask the students: What happens when water or ice seeps down into these hot rocks? (Answer: They make steam, like geysers.)

(Project diagram 3 transparency for question 5 to show where this happens.)

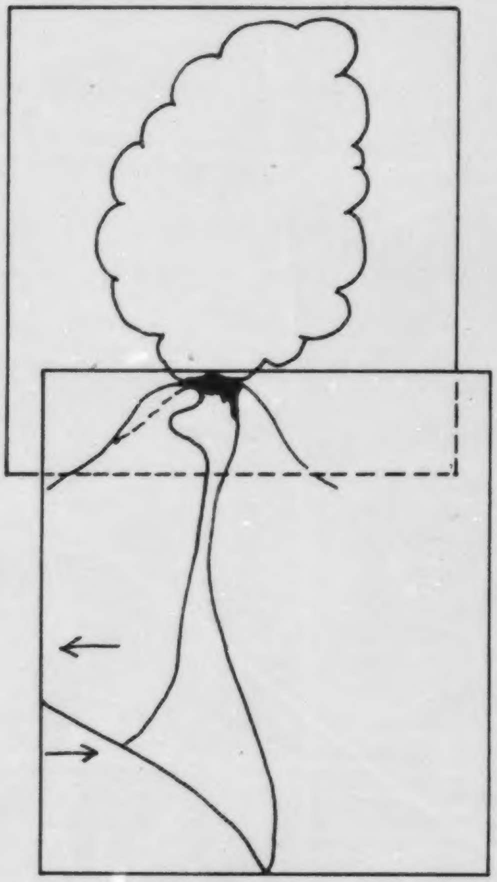
Sometimes the steam carried ash up into the air with it. This is not a real volcanic eruption — because no magma spills out or shoots up. With steam vents (fumaroles) the same old steam and ash shoot up and fall back. With a real volcanic eruption, new material that's never been on the earth's surface before comes out of the mountain. They can look a lot alike.

c. Place transparencies clipped off-center over transparencies of diagram 3, modify the diagrams (or at upper levels have student volunteers modify) to show visually the distinction just given verbally. The magma in the neck should already be colored red.

Show the two types of eruption. Use a blue pen to represent the eruption. The plumes should look similar in both completed drawings (see below) but the blue will extend well into the magma chamber to show volcanic eruption, and only into the heated rocks to show steam eruptions.



Volcanic Eruption



Steam Venting (Fumaroles)

6. Discussion question: Why can't we tell for sure when a volcano will erupt?

a. Hand out dittoes of diagram 3. Name things in it that we can be sure of (height of mountain, sea level, presence of rock and ice).

b. Tell the students to trace the following lines black: height of mountain, sea level, presence of rocks and ice.

c. Name things in the diagram that are inferred. (Location of magma, depth of crust of earth, size and location of magma tubes).

d. Tell the students to trace the following lines red: location of magma, depth of crust of earth, size and location of magma tubes.

It's because we don't know for sure what's there that we can't tell for sure what will happen.

7. Discussion question: What might happen next?

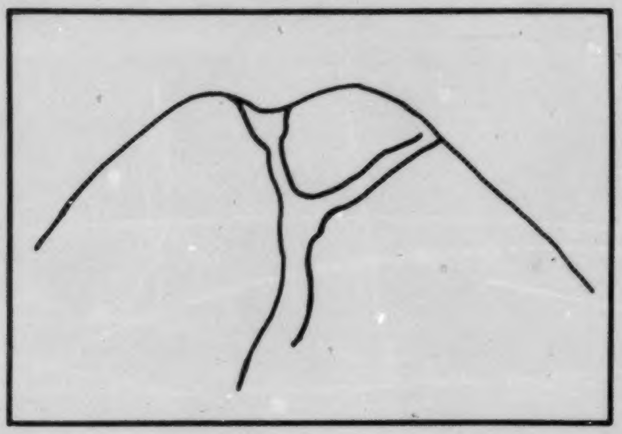
a. Give the students diagram 4 ditto and have them again trace in black the parts we're sure of and in red the parts that are inferred as done with diagram 3 under Discussion Question 6. Demonstrate on diagram 4 transparency.

b. Put a blank transparency over your No. 4 trasparency.

c. Start discussion with one of the conditions listed below, sketching it on the blank transparency if you wish. When a student responds, assign that student the job of showing the result on his or her ditto. Then put a new blank transparency over diagram 4. If students suggest other possibilities, great; if not, go on to another of the conditions below.

1. Perhaps magma will push up gently through the neck (color in the tube and bottom and crater red). Who can show on their ditto where it might flow?
Magma might flow over the lower lip of the crater and down the north side of the mountain.

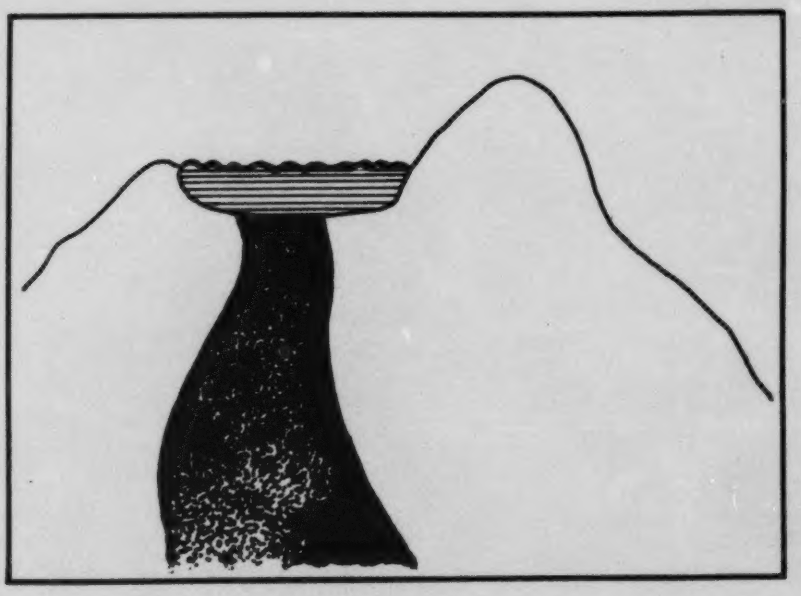
2. Perhaps another pipe will develop going toward the south side. (Draw a magma chamber on other side of tube) like this:



Who can show on their ditto what might happen?
Magma might: (1) push through to the surface and flow down the south side below this point, (2) cause a violent explosion, perhaps after creating another bulge, or 3) cool and harden into solid rock without ever getting to the surface.

3. Perhaps the crater will fill with water from rain and snow (show in blue on transparency) but the rocks underneath stay hot from the magma. What might happen then?

Lots of steam, geysers, water in lake would be warm.



4. Perhaps the two rocky plates about 25 miles (40 kilometres) beneath our feet will suddenly start moving fater, and the friction will turn more rocks into magma. Who can show on their ditto what might happen?
Probably another true volcanic eruption.

D. After this activity, post dittoes on a bulletin board, showing the different predictions, under some such caption as "Our Predictions About This Volcano." Label them for primary students, stating the conditions which generated the prediction, such as "This is what might happen if magma pushes gently through the neck of the volcano." Older students can label their own predictions.

ADDITIONAL REFERENCES:

Sources of information behind the St. Helens cross-section:

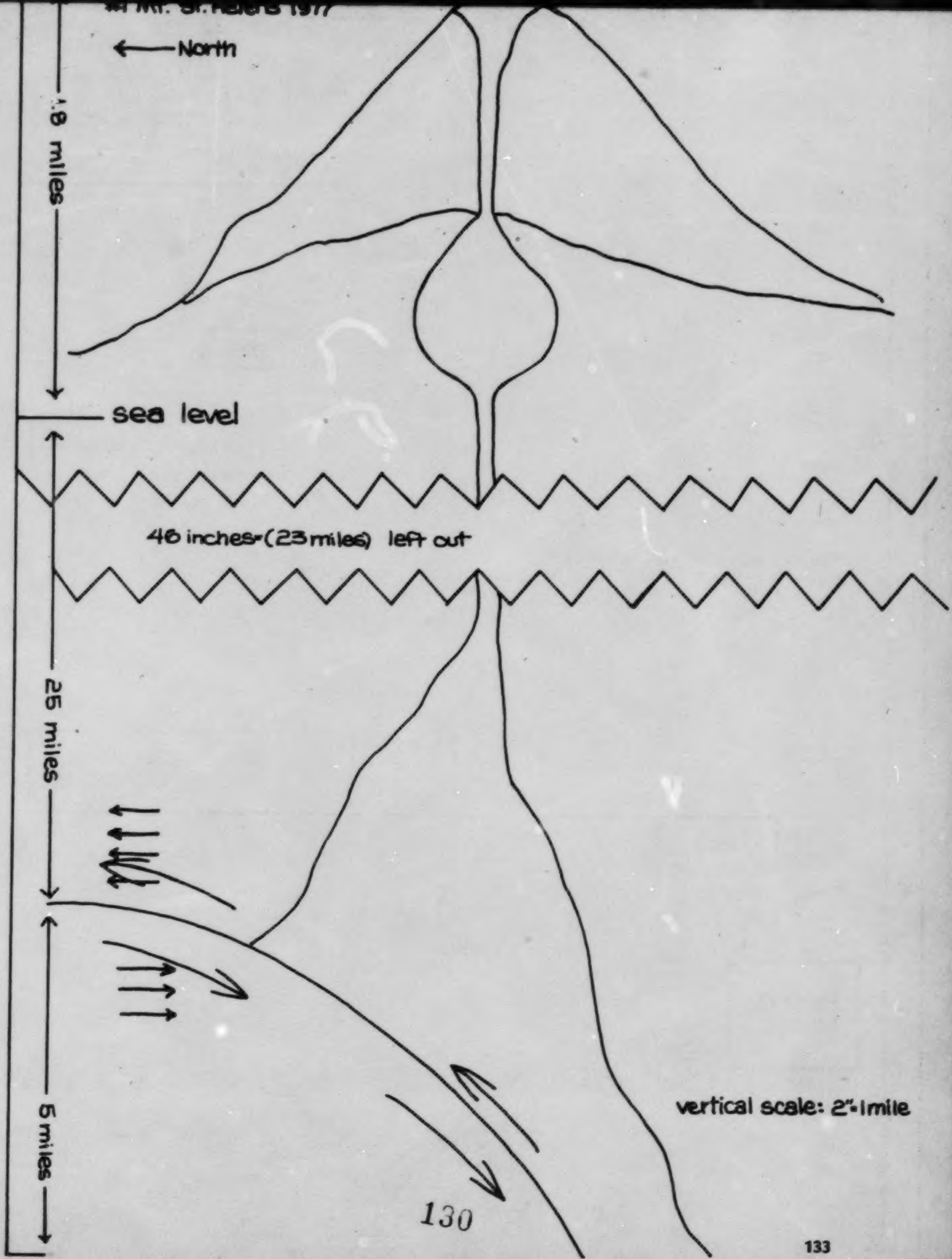
The Columbian, Vancouver, Wash., May 8, 1980 (Article, picture) and March 30, 1980)

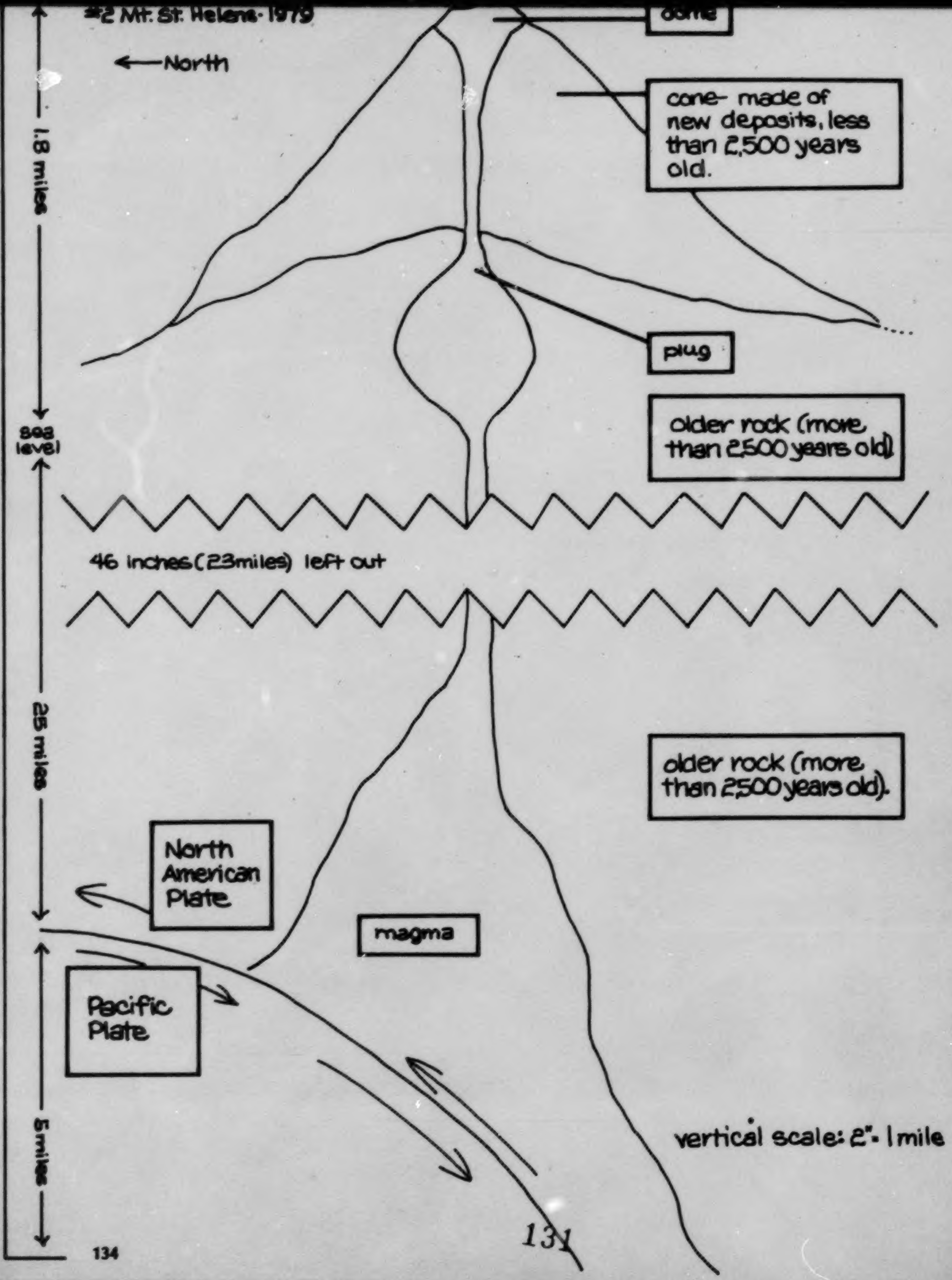
Korosec et al, 1980 Eruption of Mt. St. Helens, Washington Part I

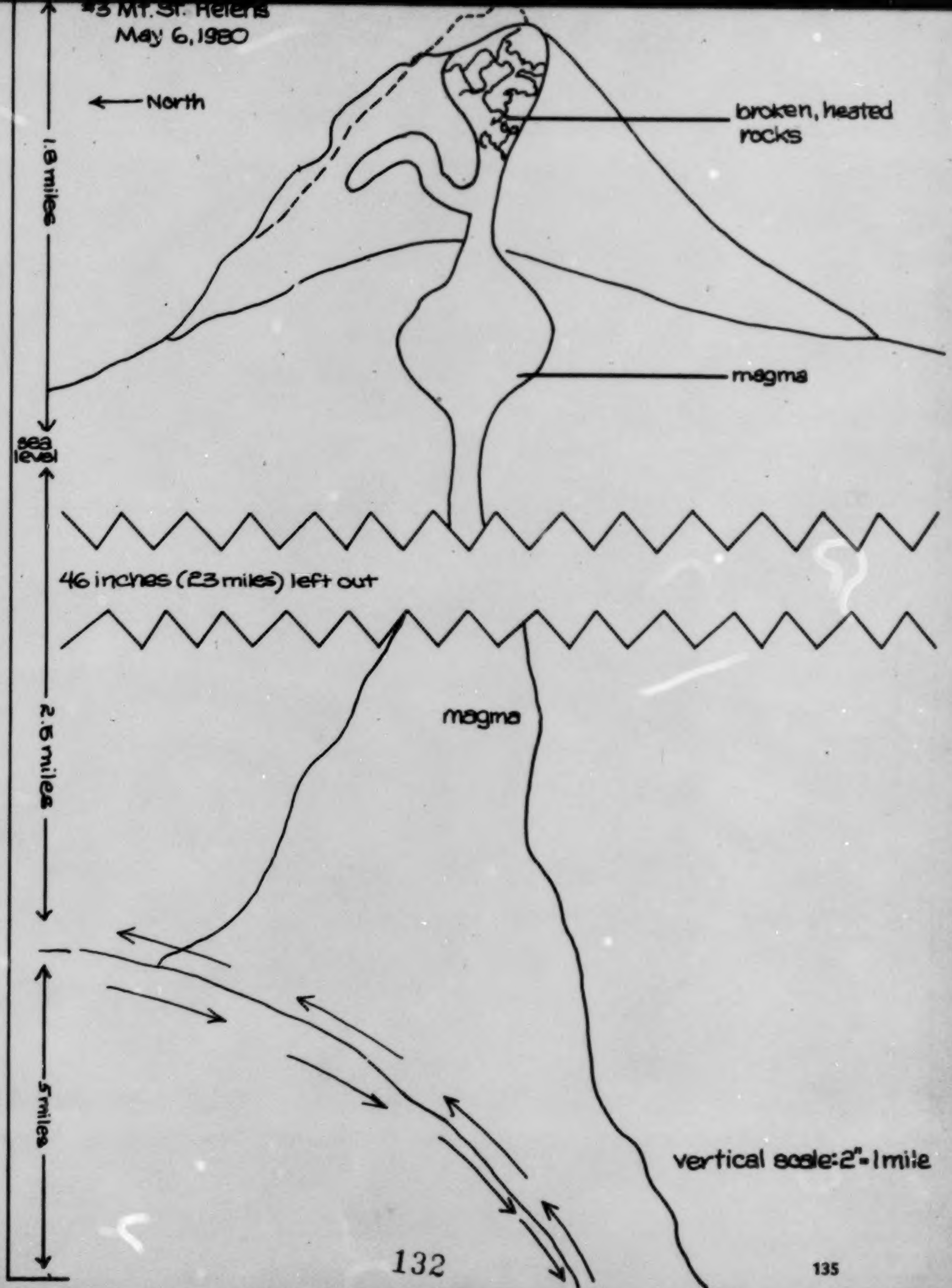
Washington Department of Natural Resources, Division of Geology and Earth Resources, June 1980, Pages 16 and 17.

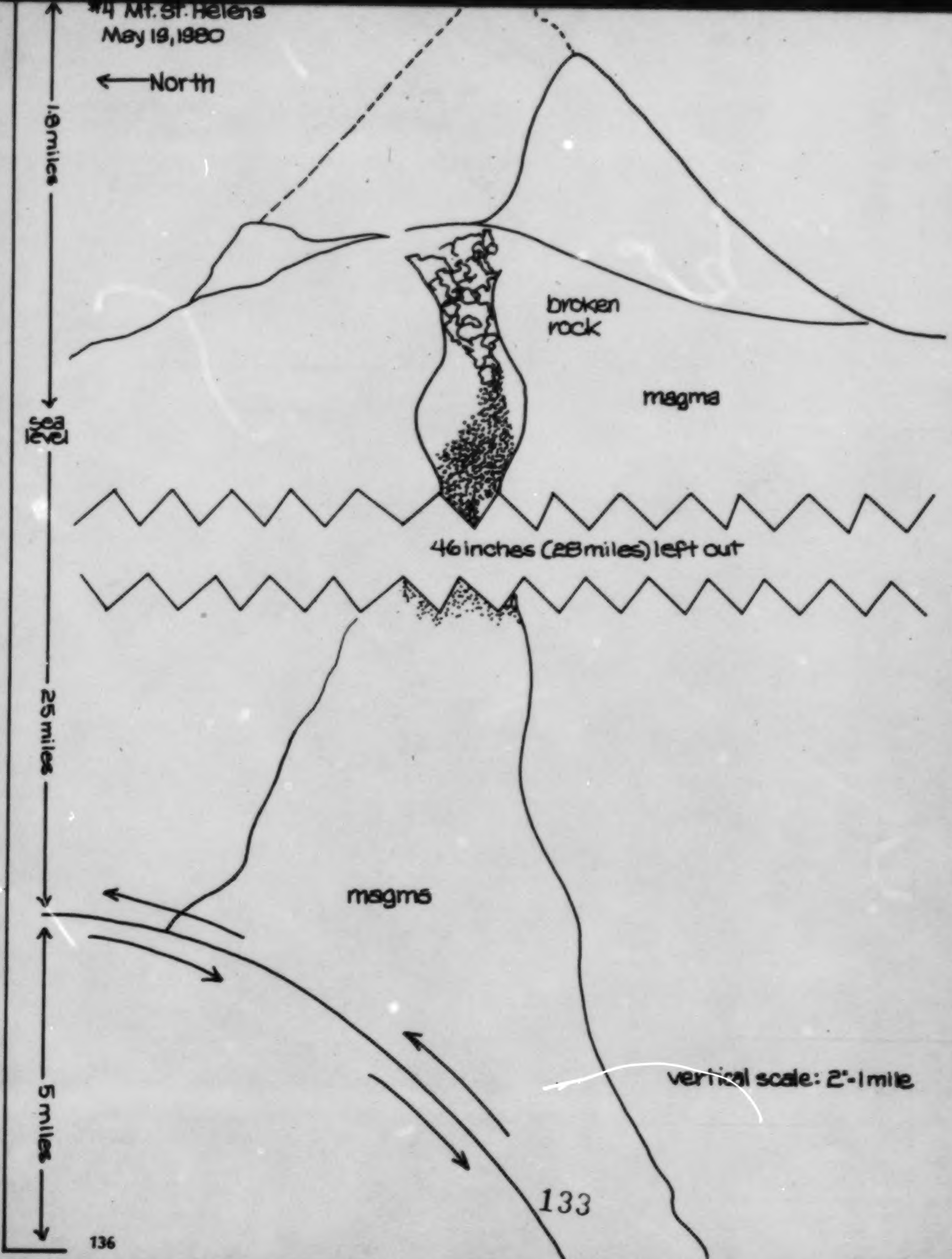
Crandell and Mullineaux; Potential Hazards from future eruptions of Mt. St. Helens Volcano, Washington — Geological Survey Bulletin 1383-C, 1980, Page C-9

McKee, Bates; Cascadia; The Geological Evolution of the Pacific Northwest, McGraw-Hill, 1972, Pages 178 and 209.


#1 Mt. St. Helens 1977
North
1.8 miles
sea level
46 inches-(23 miles) left out
25 miles
5 miles
vertical scale: 2"=1mile


#2 Mt. St. Helens-1979
North
dome
cone- made of new deposits, less than 2,500 years old.
plug
older rock (more than 2,500 years old)
1.8 miles
sea level
46 inches (23 miles) left out
25 miles
older rock (more than 2,500 years old).
North American Plate
magma
Pacific Plate
5 miles
vertical scale: 2" - 1 mile


#3 Mt. St. Helens
May 6, 1980
North
broken, heated rocks
1.8 miles
magma
sea level
46 inches (23 miles) left out
magma
2.5 miles
5 miles
vertical scale: 2" = 1 mile



#4 Mt. St. Helens
May 19, 1980
North
1.8 miles
sea level
broken rock
magma
46 inches (28 miles) left out
25 miles
magms
5 miles
vertical scale: 2"-1 mile

WHAT'S INSIDE A VOLCANO?

REFERENCE ARTICLE: — "Quiet broken by new eruption," Page 11

MATERIALS:
Red and black crayon or pencil
Drawing paper, pencil

PROCEDURE:
Watch the demonstrations and look at the diagrams. Answer the study questions.

QUESTIONS:

For Ditto No. 1

1. Why did you color the magma chamber red?

Because it is very hot.

2. Is there more magma at the top or at the bottom of the page?

Bottom.

For Ditto No. 2

1. Why is the rock so hot right under the volcano.

Because of friction between two plates.

2. What will happen on the surface of the earth when rocks beneath grind past each other?

It will shake.

3. What will happen if there's a weak spot above the magma?

Magma will be squeezed into it. If the magma comes to the top a volcano begins to form.

For Ditto No. 3:

1. Give two ideas about the cause of the bulge after reading "Quiet Broken by New Eruption."

Movement of lava or movement of cracked rocks (friction).

2. Why can the tube under the bulge be colored black?

Not all the material is magma.

3. Why can the table under the bulge be colored red?

Some magma may be present.

NAME: ______________________________ DATE: ______________

WHAT'S INSIDE A VOLCANO?

REFERENCE ARTICLE: — "Quiet broken by new eruption," Page 11

MATERIALS:
Red and black crayon or pencil
Drawing paper, pencil

PROCEDURE:
Watch the demonstrations and look at the diagrams. Answer the study questions.

QUESTIONS:

For Ditto No. 1

1. Why did you color the magma chamber red?
2. Is there more magma at the top or at the bottom of the page?

For Ditto No. 2

1. Why is the rock so hot right under the volcano.
2. What will happen on the surface of the earth when rocks beneath grind past each other?
3. What will happen if there's a weak spot above the magma?

For Ditto No. 3:

1. Give two ideas about the cause of the bulge after reading "Quiet broken by new eruption."
2. Why can the tube under the bulge be colored black?
3. Why can the table under the bulge be colored red?

LEVEL INFORMATION: SS/LA P/I

EMERGENCY

OBJECTIVE:
The students will:
1. **Clarify their priorities.**
2. **Describe steps necessary to evacuate their family on very short notice.**
3. **Describe what should be ready in emergencies.**

TEACHING SUGGESTIONS:
1. **The three activities in the unit build on each other. If you do these over an extended time period (several days) be sure to review each activity before proceeding.**
2. **Tell the students to read the two reference articles in "Mount St. Helens".**
3. **Conduct a discussion based on the questions in Activity I.**
4. **Assist the students to complete Activity II.**
5. **Help the students regroup for Activity III and tell them to follow the directions.**

EMERGENCY

REFERENCE ARTICLES:
— "Ominous, eerie hush falls," Page 28
— "Mud turns dream to nightmare," Page 30

PROCEDURE:
1. Read the reference articles.

ACTIVITY I — DECIDE WHAT IS IMPORTANT

1. Imagine that you have just received a report that a mudflow is coming down the river toward your home and you only have 15 minutes to evacuate. You can only take what you can fit into one small suitcase. Describe what you would bring with you, and why.

2. The Althofs found only one possession in the river. Try to think of one possession that would be of comparable personal value that you would want to find in the river.

3. The Althof teakettle is muddy, dented and less than a thing of beauty. Do you think they will throw it away or save it? Why?

ACTIVITY II — PRIORITIES

1. Divide into groups of 6.
2. List your group's highest priorities from Activity I, Question 2.
3. Categorize these priorities (for example, something to wear, paper, etc.)
4. Assign each group member one of the following roles:
   a. (1) Grandmother
      (2) mother/father
      (3) college student
      (4) teen-ager
      (5) third-grader
      (6) kindergartener

   b. As the role player, list what you think should go into the suitcase.

   c. Carry out a conversation you might have had when the word came that the family would be evacuated in 15 minutes. Try to come to a consensus on what should go into a suitcase.

   d. List below the suitcase contents.

   e. Did everyone in the family include a personal momento or were family momentoes included, or both? Why?
5. List any similarities between decisions you made in the role play and the priorities you listed in Question 2.

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ACTIVITY III — GET TOGETHER

Form new groups, composed of students playing the same role in the play (i.e. all grandmothers in one group, all mothers/fathers in one group, etc.)

1. List the similarities you find in the role plays of things chosen for the suitcase from activity II, 4c.
2. Categorize these similarities. Make a list of the categories.

EXTENDED ACTIVITY — MUDFLOW:

1. Imagine you are an archeologist from the 25th century excavating the St. Helens mudflow. As you dig down through the layers of dirt, mud, silt and rock, you find the following items: a leather boot; a digital watch; a Volkswagen Beetle; a pocket calculator; an aluminum pop can; a rubber raft; and a steel-belted radial tire. Write a report explaining what conclusions you would draw about life in Washington at the time of the Mount St. Helens eruption.
2. Try to associate the pioneers who left their possessions behind to cross the Rocky Mountains to the people that left their home because of Mount St. Helens. What did they have in common and what were the differences?

Possible answer: Common — both could not take many items with them. Differences — Pioneers were looking for a new home; the Mount St. Helens refugees were leaving their home.

NAME:______________________________ DATE:______________

EMERGENCY

REFERENCE ARTICLES:
- "Ominous, eerie hush falls," Page 28
- "Mud turns dream to nightmare," Page 30

PROCEDURE:
1. Read the reference articles.

ACTIVITY 1 — DECIDE WHAT IS IMPORTANT

1. Imagine that you have just received a report that a mudflow is coming down the river toward your home and you only have 15 minutes to evacuate. You can only take what you can fit into one small suitcase. Describe what you would bring with you, and why.

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NAME: ______________________________ DATE: ______________

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2. List your group's highest priorities from Activity I, Question 2.

3. Categorize these priorities (for example, something to wear, paper, etc.)

4. Assign each group member one of the following roles:
   a. (1) Grandmother
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      (4) teen-ager
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   d. List below the suitcase contents.

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Why?

5. List any similarities between decisions you made in the role play and the priorities you listed in Question 2.

NAME: ____________________ DATE: __________

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EXTENDED ACTIVITY — MUDFLOW:

1. Imagine that you are an archeologist in the 25th century excavating the Mount St. Helens mudflow. As you dig down through the layers of dirt, mud, silt and rock, you find the following items: a leather boot; a digital watch; a Volkswagen Beetle; a pocket calculator; an aluminum pop can; a rubber raft; and a steel-belted radial tire. Write a report explaining what conclusions you would draw about life in Washington at the time of the Mount St. Helens eruption.

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LEVEL INFORMATION: SS/SCI P/I

ASH AFFECTS PEOPLE

OBJECTIVES:
The students will:

1. Describe several ways in which ash affects people's lives.
2. Identify cities most heavily affected by ash.

TEACHING SUGGESTIONS:

1. Read the reference articles to the students or have a student read them to the class.
2. Brainstorm effects of ash fall with students. Write responses on the board.
3. Break up into small groups of 4-5 to answer questions. You may wish to assign one question to each group. After 10-15 minutes share the group's answers.

Activity II may first be done as a class so students can see the need for a family unit to work together, or if this gives them too much difficulty, simply brainstorm a few ideas on what should be done.

In Activity III, You may wish to change some of the family members to suit your own needs. Also, alternate situations also can be explored. For example:

1. A mother or father explaining the need to wear an ash mask to an uncooperative youngster.
2. Family discussion about ash clean up around the house — who does what, etc. No one wants to shovel.
3. A frazzled teacher and students who have not been able to go outside during recess for two weeks. Finally, a chair or window gets broken.

ASH AFFECTS PEOPLE

REFERENCE ARTICLES:

— "Lung problems up at Moses Lake," Page 24
— "Gritty stuff brings early summer vacation," Page 24
— "Dust driving longtime Cougar residents out, Page 21
— "Conflicting views erupt on ash effect," Page 23
— "Worker safety topic of ash investigation," page 22
— Photomicrograph," page 23
— "Violence up in ash-clogged areas," Page 23
— "Ash loss to farmers put at $175 million," Page 25
— Map, Page 26

PROCEDURE:
After reading the reference articles, answer the following questions:

1. How could ash damage homes?

Ash is so fine it gets into homes through the smallest openings. It scratches almost everything it rubs against. It will cut fabrics if not cleaned up soon.

2. How does ash affect the air we breathe?

Ash in the air is choking to breathe. Special face masks should be worn when enough is there to make it visible.

3. How does ash affect water supply and waste treatment plants?

Ash clogs filters in water treatment plants. It can damage pumps and fills waste treatment plants with material that does not break down.

4. How does ash affect transportation?

Ash is very abrasive on all machinery with moving parts. It plugs air filters, gets into fuel systems, and has ruined a jet engine in less than five minutes. The dust on roads is slippery and reduces visibility to as little as 3 feet.

5. How much ash fell on different cities in Washington state? (List six cities and the amount of ash).

Yakima, 15mm; Moses Lake, 50mm; Ritzville, 60 mm; Ellensburg, 15mm; Ephrata, 30 mm; Pasco, Trace; Wenatchee, 2mm; and Spokane, 15 mm.

6. What are some of the ways in which cities were affected by ash?

Cities in line with the ash cloud were disrupted according to the amount of ash received.

7. What was the effect of ash on farm crops? On animals?

Many farm crops were covered. Fruit trees had ash blown off with helicopters, hay crops could not be used if too much ash was present as animals would not eat them. Vegetable gardens had small plants covered by ash. Ash sometimes caked on the soil so water could not easily penetrate.

Some animals had their lungs affected by the dust. Cows will have their teeth worn down by ash-covered grass and hay. Most animals in the devastated area were destroyed. Birds left their nests. The insect population was destroyed in many places and there was no food. Fish in ash-filled streams died due to the high temperatures, the abrasive action of the ash on their gills and suffocation due to the lack of oxygen. If the fish survived the ash and temperatures, they found their food supply had been destroyed.

8. The term "prisoner in your own home" might apply to the ash situation. Why would somebody in a heavy ash area feel this way?

Many people could not escape the ash effected area and if they had breathing problems they were stranded at home.

9. How do you think people would change if they were always in an area of ash fallout?

Answers will vary. If a person were subjected to heavy ash fallout they could become depressed, fearful, violent or apathetic about themselves and those around them.

10. In the article, "Violent acts erupt in ash-clogged areas of state," there appears to be some link between what people do and the ash fall. Why do you think this is or is not so?

Answers vary

ACTIVITY II — WARNING — ASH FALL!

If you knew that an ash fall was heading your way in two hours, what sort of things do you think a family should do before it becomes dangerous outside? Use your own family as an example. Consider food needed, protective wear, the pets, the garden, the home. List below what you feel each family member's responsibilities would be.

Mother

Father

You

Brother

Sister

ACTIVITY III — OUT OF SUPPLIES

Your family has just run out of bread, milk, eggs and meat after a three day ash fall in your city. In groups of 4, role play what happens next. The characters are: Father, mother, teen-ager, third-grader.
Remember the gray outdoors, the ash masks, the low visibility and the ash effects. When finished write down below what your "family" did.

NAME: ______________________________ DATE: ______________

ASH AFFECTS PEOPLE

REFERENCE ARTICLES:

— "Lung problems up at Moses Lake," Page 24
— "Gritty stuff brings early summer vacation," Page 24
— "Dust driving longtime Cougar residents out, Page 21
— "Conflicting views erupt on ash effect," Page 23
— "Worker safety topic of ash investigation," page 22
— Photomicrograph, page 23
— "Violence up in ash-clogged areas," Page 23
— "Ash loss to farmers put at $175 million," Page 25
— Map, Page 26

PROCEDURE:

After reading the reference articles, answer the following questions:

1. How could ash damage homes?

2. How does ash affect the air we breathe?

3. How does ash affect water supply and waste treatment plants?

4. How does ash affect transportation?

5. How much ash fell on different cities in Washington state? (List six cities and the amount of ash).

6. What are some of the ways in which cities were affected by ash?

7. What was the effect of ash on farm crops? On animals?

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9. How do you think people would change if they were always in an area of ash fallout?

10. In the article, "Violent acts erupt in ash-clogged areas of state," there appears to be some link between what people do and the ash fall. Why do you think this is or is not so?

NAME: ______________________________ DATE: ______________

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Sister

NAME: ________________________________ **DATE:** ______________

ACTIVITY III — OUT OF SUPPLIES!

Your family has just run out of bread, milk, eggs and meat after a three-day ash fall in your city. In groups of 4, role play what happens next. The characters are: Father, mother, teen-ager, third-grader.

Remember the gray outdoors, the ash masks, the low visibility and the ash effects. When finished write down below what your "family" did.

LEVEL INFORMATION: SCI/SS P/I

DAMAGED TREES

OBJECTIVE:
The student will identify several problems related to collecting damaged trees.

TEACHING SUGGESTIONS:

1. **View and discuss the pictures with the class.**
2. **Have small groups brainstorm problems associated with the damaged materials.**

DAMAGED TREES

REFERENCE ARTICLES:

- Photos, Pages 16 and 17
- Map, Page 31
- Photos, Page 48

PROCEDURE:

1. Examine the pictures on pages 16, 17, 31 and 48. See how many kinds of damage you can find. Note how the trees are scattered. Notice trees, or parts of trees, left standing. Look at how the ash has fallen around the timber.
2. Participate in class discussion dealing with the use of damaged lumber.
3. Answer the questions.

QUESTIONS:

1. What might happen if the trees are left there?

The trees that are left where they fell may (1) be burned in forest fires; (2) be infested with insects; or (3) decay and return to soil.

2. How might ash make it hard to save the logs?

Ash can damage machines (chainsaws, logging equipment, etc.) and it is slippery to work in. It is very dusty.

3. What do you think ash might do to machinery?

Ash is very abrasive where it gets into moving parts and it clogs air filters in engines.

4. What does ash do that makes it hard for men to work in affected areas?

Special air filters have to be used by workmen to breathe through. The ash on logs and on the ground is loose and slippery, but very hard to shovel. It weighs 120 lb/ft3.

5. What other problems are associated with attempting to use the damaged trees? List as many as you can.

Answers will vary.

6. Do you think the blast down area should be reforested or should it be preserved as a park? Why?

Answers vary

NAME: ____ DATE: ______________

DAMAGED TREES

REFERENCE ARTICLES:
— Photos, Pages 16 and 17
— Map, Page 31
— Photos, Page 48

PROCEDURE:

1. Examine the pictures on pages 16, 17, 31 and 48. See how many kinds of damage you can find. Note how the trees are scattered. Notice trees, or parts of trees, left standing. Look at how the ash has fallen around the timber.
2. Participate in class discussion dealing with the use of damaged lumber.
3. Answer the questions.

QUESTIONS:

1. What might happen if the trees are left there?

2. How might ash make it hard to save the logs?

3. What do you think ash might do to machinery?

4. What does ash do that makes it hard for men to work in affected areas?

5. What other problems are associated with attempting to use the damaged trees? List as many as you can.

6. Do you think the blast down area should be reforested or should it be preserved as a park? Why?

LEVEL INFORMATION: SCI P/I

TOTAL SUSPENDED SOLIDS IN TOUTLE RIVER

OBJECTIVE:

The student will compare samples of suspended solids in water with available date and relate them to fish survival.

TEACHER BACKGROUND:

The Toutle and Cowlitz rivers are still carrying a great quantity of sediment and suspended solids resulting from the mudflow caused by the eruption of Mount St. Helens on May 18, 1980.

Two kinds of technical measurements are taken monthly by the Washington state Department of Ecology. One, a measurement of turbidity, or how clear the water is, is reported in Jackson Turbidity Units (JTU), a national standard. The second is a measure of the weight of solids suspended in the water, and is reported as Total Suspended Solids (TSS) in milligrams per litre.

If desired, small groups can do each part of Activity I independently. The data collected could then be displayed on the chalkboard, or a large piece of butcher paper.

TOTAL SUSPENDED SOLIDS IN TOUTLE RIVER

REFERENCE ARTICLES:

— Appendix II
— "Toutle begins process of cleaning itself," Page 29
— Photo, Page 29
— "Gloomy Prediction . . . .," Page 47
— "Fish, game lost," Page 46
— "Photomicrograph of ash," Page 23
— "Farewell to the Beautiful River," Page 28

MATERIALS:

Three clear litre containers with lids (quart mayonnaise jars are very close to a litre)
Ash (or soil or fine sand)
Centigrade thermometer

BACKGROUND:

The Toutle River was heavily hit by a mudflow. Many things will affect how fast this mud can settle to the bottom. You will be watching three of these things. They are (1) The amount of material in the water; (2) the temperature of the water; and (3) the type of material in the water.

In parts A and B, be certain that the material is uniform in all three containers. If metric measurement is not satisfactory, use a similar measurement in tablespoons or ounces.

PROCEDURE:

PART A. The Amount of Material

1. Fill each container with about one litre of water.
2. Put .03 grams of ash or sand in container 1.

If this measurement is difficult, put nothing in this container and explain the situation to the students.

Put 5g in container 2

Put 10g in container 3

3. Shake the container vigorously.
4. (a) Watch the containers. After three minutes, record which container was the cloudiest with a plus (+) sign.

If they all seem about the same, put a check mark (✓) by each.

.03g	5g	10g +	Cloudiest

(b) Record which container had the most material at the bottom below with a plus. If they all seem about the same, put a check by each.

.03g	5g	10g +	Amount on bottom

This water should be heated in advance to avoid delays.

PART B:

1. Fill container A with water and heat to 35 degrees Celsius. Fill container B with water at 25 degrees Celsius. Fill container C with water at 15 degrees Celsius.
2. Put 10g material in each and shake.
3. (a) Watch the containers. After three minutes record below which container was the cloudiest with a plus. If they appear to be the same, put a check by each.

15 degrees C.	25 degrees C.	35 degrees C. +	Cloudiest

(b) Record below which container had the most material on the bottom. If they were all the same, put a check by each.

15 degrees C. +	25 degrees C.	35 degrees C.	Amount on bottom

Part C:

1. Fill containers A, B and C with cold water.
2. Put 10g of sand into container A. Put 10g of talcum powder into container B. Put 5g each into container C.
3. Shake the containers.
4. (a) After three minutes, record below which container was the cloudiest with a plus. If they were all the same, put a check by each.

10g sand	10g powder +	5g each	Cloudiest

(b) Record below which had the most material in the bottom. If they were all the same, put a check by each.

10g sand +	10g powder	5g each	Amount on bottom

QUESTIONS:

1. What two things kept the water the cloudiest?
For example, fine material (talcum powder).

High temperature. Greater amount of material.

2. What two things made the most amount of material on the bottom. For example, more material.

Cold temperature. Coarse material

3. How is a river different than a jar of water?

River has a current.

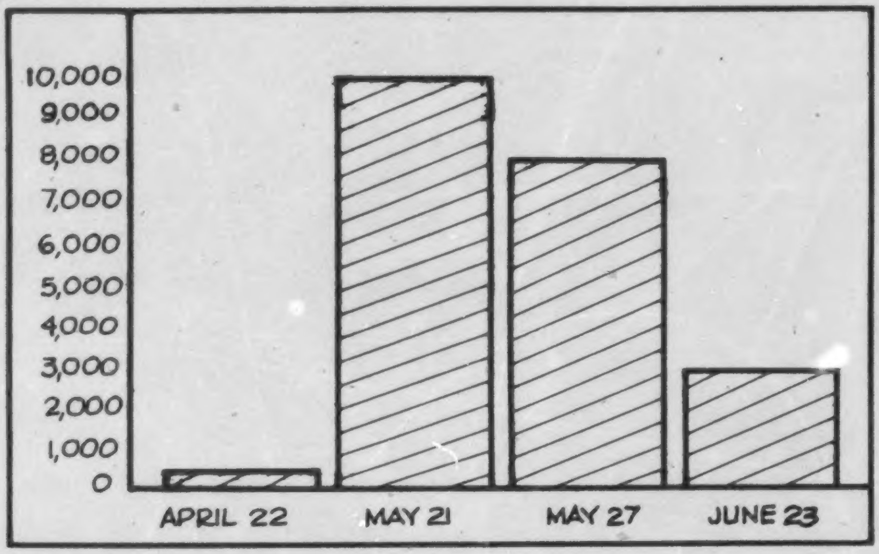
4. Do you think this difference might change how fast the material settles to the bottom? Why?

This question could be answered as a class discussion. The rate of flow would keep the finer material in suspension longer.

ACTIVITY II — THE BAR GRAPH

On the graph below, construct a bar graph showing the amount of total suspended solids in the Toutle River on four different dates. The dates and amounts are in the chart below.

April 22	7 TSS
May 21	9,800 TSS
May 27	7,100 TSS
June 23	3,100 TSS



1. Do you think the river will be back to 7 TSS by July 23 (one month later)? Why?

No. Between May 27 and June 23, a 50 per cent reduction occurred. If a 50 per cent reduction occurs between June 23 and July 23, this would be 1550 TSS, which is a great deal larger than 7 TSS.

2. How much suspended solids were lost between May 21 and 27?

9,800 - 7,100
2,700 in six days

Between May 27 and June 23?

7,100 - 3,100
4,000 in 27 days

3. Which rate of clearing is faster?

May 21-27

Even if the students are not dividing they should be able to see how much more was lost immediately after the mudflow compared to the amount lost a month later.
List some reasons why this rate was so much faster.

Heavier material settles quickly. Current carried much material downstream.

EXTENDED ACTIVITY:

Write each rate (May 21-27) (May 27-June 23) as a loss/day.

2,700/6450 TSS/day
4,000/27'48 TSS/day

ACTIVITY III — SALMON SURVIVAL

1. Read the articles:
— "Fish, game lost," Page 42
— "Gloomy prediction . . ." Page 47

Or read these articles to the students

2. The suspended solids were killing the fish. Be sure to look at the picture of the ash on Page 23. Much of the material in the river is that rough. What reasons can you list that caused the fish to die?

The gill structure which traps the oxygen becomes clogged. Also, the abrasive action of the ash upon the gill structure may cause the fish to bleed to death. The available oxygen in the water, which is needed by the fish, is depleted. (You may want to bring a fish to show its gill structure.)

NAME: ______________________________ DATE: ______________

TOTAL SUSPENDED SOLIDS IN TOUTLE RIVER

REFERENCE ARTICLES:

- Appendix II
- "Toutle begins process of cleaning itself," Page 29
- Photo, Page 29
- "Gloomy Prediction . . . .," Page 47
- "Fish, game lost," Page 46
- "Photomicrograph of ash," Page 23
- "Beautiful valley now desolate wasteland," Page 28

MATERIALS:

Three clear litre containers with lids (quart mayonnaise jars are very close to a litre)
Ash (or soil or fine sand)
Centigrade thermometer

BACKGROUND:

The Toutle River was heavily hit by a mudflow. Many things will affect how fast this mud can settle to the bottom. You will be watching three of these things. They are (1) The amount of material in the water; (2) the temperature of the water; and (3) the type of material in the water.

PROCEDURE:

PART A — The Amount of Material:

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2. Put .03 grams of ash or sand in container 1.
   Put 5g in Container 2
   Put 10g in Container 3
3. Shake the container vigorously.
4. (a) Watch the containers. After three minutes, record which container was the cloudiest with a plus (+) sign.
If they all seem about the same, put a plus (+) by each.

.03g	5g	10g	Cloudiest

(b) Record which container had the most material at the bottom below with a plus. If they all seem about the same, put a check by each.

.03g	5g	10g	Amount on bottom

PART B:

1. Fill container A with water and heat to 35 degrees Celsius. Fill container B with water at 25 degrees Celsius. Fill container C with water at 15 degrees Celsius.
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3. (a) Watch the containers. After three minutes record below which container was the cloudiest with a plus. If they appear to be the same, put a check by each.

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same, put a check by each.

10g sand	10g powder	5g each	Cloudiest

(b) Record below which had the most material in the bottom. If they were all the same, put a check by each.

10g sand	10g powder	5g each	Amount on bottom

QUESTIONS:

1. What two things kept the water the cloudiest? For example, fine material (talcum powder).

2. What two things made the most amount of material on the bottom. For example, more material.

3. How is a river different than a jar of water?

4. Do you think this difference might change how fast the material settles to the bottom? Why?

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NAME: ______________________________ DATE: ____________

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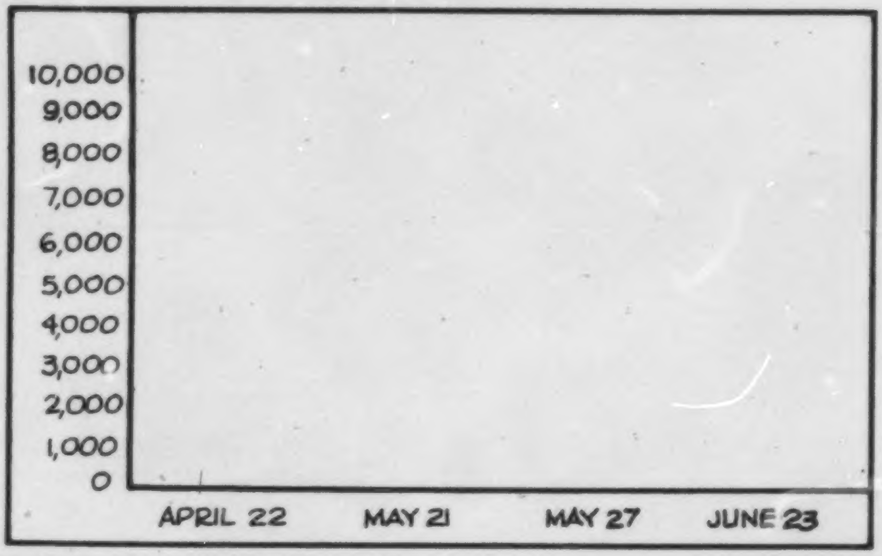

1. Do you think the river will be back to 7 TSS by July 23 (one month later)? Why?

2. How much suspended solids were lost between May 21 and 27?

Between May 27 and June 23?

3. Which rate of clearing is faster?

List some reasons why this rate was so much faster.

EXTENDED ACTIVITY:

Write each rate (May 21-27) (May 27-June 23) as a loss/day.

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NAME: ______________________________ **DATE:** ______________

ACTIVITY III — SALMON SURVIVAL

1. Read the articles:
— "Fish, game lost," Page 42
— "Gloomy Prediction . . .," Page 47

2. The suspended solids were killing the fish. Be sure to look at the picture of the ash on Page 23. Much of the material in the river is that rough. What reasons can you list that caused the fish to die?

LEVEL INFORMATION: I SS

PEOPLE, SHIPS, LOGS AND TRAVEL vs. MUDFLOW

OBJECTIVE:
The students will describe in their own words the effects of mudflows on people and their property, transportation and the logging industry.

PEOPLE, SHIPS, LOGS AND TRAVEL vs. MUDFLOW

REFERENCE ARTICLES:
- Photo, Page 31
- "Couple struggle for life," Page 40
- "Ominous, eerie hush," Page 28
- Photo, Cowlitz and Toutle rivers meet, Page 29
- "Tragedy's toll . . .," Page 30
- "Mud From volcano clogs Columbia River," Page 32
- "Volcano's effects less than feared," Page 32

PROCEDURES:
Read the reference articles.

QUESTIONS:

1. What did the mudflows do to trucks and machines?

The mudflows buried the trucks and machines or badly damaged them.

2. What did the mudflows do to the log piles?

The log piles were scattered and floated away.

3. How did the mudflows affect people's travel in the valley?

People can no longer travel over roads that were flooded or over washed-out bridges.

4. Why is a low area next to the river a poor place to build?

Low areas are frequently flooded even in normal times. Mudflows demolished many buildings.

5. How did mudflows affect ship traffic in the Columbia River?

Ship traffic was completely halted for a period of time because large ocean ships often draw up to 35 feet and mud filled the Columbia ship channel from its normal 40 foot depth to only 15 feet.

NAME: ______________________________ DATE: ______________

PEOPLE, SHIPS, LOGS AND TRAVEL vs. MUDFLOW

REFERENCE ARTICLES:
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- "Couple struggle for life," Page 40
- "Ominous, eerie hush," Page 28
- Photo, Cowlitz and Toutle rivers meet, Page 29
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- "Volcano's effects less than feared," Page 32

PROCEDURES:
Read the reference articles.

QUESTIONS:
1. What did the mudflows do to trucks and machines?

2. What did the mudflows do to the log piles?

3. How did the mudflows affect people's travel in the valley?

4. Why is a low area next to the river a poor place to build?

5. How did mudflows affect ship traffic in the Columbia River?

LEVEL INFORMATION: SS P/I

VOLCANO EFFECTS IN COUGAR

OBJECTIVES:
The students will:

1. **Identify community needs given the unusual situation.**
2. **Devise various courses of action to fulfill these needs.**
3. **Test the various courses of action they have devised by means of role playing.**

TEACHER BACKGROUND:

The following article excerpts presents the emergency action taken by the state of Washington in view of the continuing activity of Mount St. Helens. The formation of the Red Closure Zone created problems and concerns for many area residents. The excerpts in this activity present some of the problems with a focus on the small community of Cougar, Washington. These are arranged in chronological order and should be reproduced for student use. The excerpts are arranged so that you may have the students perform the activities at various stages in the sequence giving only the information necessary. For primary and intermediate students read the articles aloud and use the activity questions as a basis for discussion.

ACTIVITY I

This activity can be done individually or in small groups. Small groups would allow for more interaction. If done as a class project put the concerns described by students on the board or make a transparency of the student page for use on the overhead projector. A group of students could be assigned to each concern with their ideas presented to the class orally.

VOLCANO EFFECTS IN COUGAR

REFERENCE ARTICLES:

— "Dust driving longtime Cougar residents out," Page 21
— "Humor high despite trials and hardships," Page 33
— "Cougar residents flee, Page 45

PROCEDURE:

Read the following newspaper excerpts about Cougar, Washington. Locate Cougar on the map on page 29.

Excerpt I:

During the past 48 hours a mile-wide slab of rock and ice on Mount St. Helens has grown more unstable, fueling fears that tons of debris could crash down on the land below at any time.

That report from the U.S. Geological Survey scientists came at the same time Gov. Dixy Lee Ray signed an executive order closing Spirit Lake Highway from the mountain to a point 15 miles east of I-5.

The emergency order signed at 12:30 this afternoon prohibits anyone from entering a designated red zone around the mountain in a five-mile radius to the south, east and west of the peak. The area to the north includes the Mount Margaret area and all of Spirit Lake. The only persons allowed in the red zone are scientists and law enforcement personnel. Private property owners are banned.

A second area — the blue zone — extends five miles around the red zone and includes most of Spirit Lake Highway to a point 15 miles east of I-5. Commercial logging operations will be allowed during the daytime only.

Property owners are allowed to enter only by special permit.

State law says anyone violating this order would be subject to a $500 fine and/or six months in jail. The State Department of Transportation is currently erecting iron pole gates across the road at the Cowlitz-Skamania county line and at a point eight miles west of the county line. The gates will be locked and scientists, the State Patrol and county sheriff's officers will have keys.

Even an eruption at Mount St. Helens can't melt state red tape. The Cowlitz County Sheriff's Department will have to wait for the state to help man roadblocks near the erupting 9,677-foot peak because the county failed to follow state regulations.

"The county didn't do anything wrong," Chow said. "It just didn't do enough to satisfy the state regulations.' "

THE DAILY NEWS, Longview, Wash., April 1, 1980

Excerpt II:

COUGAR — National guardsmen armed with guns but no bullets stood watch at a new roadblock five miles west of here Saturday. They turned back tourists bent on a once-in-a-lifetime glimpse of erupting Mount St. Helens.

Several Cougar residents and business owners were fuming because the roadblock was cutting off their lifeline of tourist trade — with or without an erupting volcano. The roadblock had been moved early Saturday from east of town to west of town and it was keeping people — and their money — away.

Some residents, however, welcomed the roadblock fearing that the glut of roving outsiders this last week would cause traffic jams if an emergency evacuation became necessary.

One businesswoman threatened to consult an attorney Monday if the roadblock was not removed. "We plan on going to see an attorney and getting an injunction," Sandy Mortenson, co-owner of the Wildwood Inn, said.

THE COLUMBIAN, April 6, 1980)

Excerpt III:

A volcano-caused flood would be much the same as a spring flood to county emergency workers.

But a mudflow — far less likely than mere rising water — could be more difficult than a flood, said Nolan Lewis, Cowlitz County's emergency services director.

THE DAILY NEWS, Longview, Wash., April 12, 1980

Excerpt IV:

Is that all there is to Mount St. Helens?

The mountain showed little change Thursday, remaining in its becalmed state with an occasional hefty earthquake sending seismologists to study their graph machines.

THE DAILY NEWS, Longview, Wash./AP April 18, 1980

Excerpt V:

STEVENSON — A small property tax protest has erupted on the side of the volcano at Mount St. Helens, Skamania County Treasurer Katherine Wright said Thursday.

Three angry cabin owners in the Spirit Lake area have refused by letter to pay their 1980 property taxes because they aren't being allowed on the land, she said, adding that several other letters received during the past few days contained tax payments, but protest statements also were enclosed.

THE COLUMBIAN, May 2, 1980

Excerpt VI:

COUGAR — Four miles east of here is a roadblock that many people wish was not there. But such is the consequence of a restless volcano.

"I think people are getting kind of tired of it now. They want to go back and live their lives. The novelty has worn off," said Linda Elmire, a clerk at the Cougar Store.

"Everybody wishes all the roadblocks would come off — and the fishing,' she said."

THE COLUMBIAN, May 4, 1980

Excerpt VII:

Three little words make a world of difference for Marge Olson's cafe-tavern along the Lewis River below Mount St. Helens.

To drive to her Beaver Bay Cafe, people must pass a sign in Cougar, three miles to the west, that says "Local Traffic Only." But drivers don't encounter a roadblock until they pass Mrs. Olson's cafe.

"My business is almost killed because of that sign," Mrs. Olson said.

"If it's so dangerous and so terrible up here, why are people working in the area?" Loggers and Forest Service workers are allowed past the roadblock during daylight hours.

THE DAILY NEWS, Longview, Wash., May 14, 1980

Excerpt VIII:

Cowlitz County Sheriff Les Nelson said this morning that private search parties in the disaster area may have been caught by Sunday morning's ash fallout.

Nelson also took issue with the people who have criticized the official rescue operations as well as those involved in the private search parties.

"I understand and I sympathize with those people who have lost loved ones, but people have to appreciate that there is a way to do these things," he said. "The people who throw a pack on their back and go in there are actually contaminating the rescue scene."

Nelson said there was some confusion among the many agencies involved in search and rescue efforts. "But you show me where they've handled a volcanic eruption better. It's not fair to criticize people who have worked this hard"

THE DAILY NEWS, Longview, Wash., May 26, 1980

Excerpt IX:

"We've already filled out waivers that we wouldn't sue the state or the county. We're just redoing the same thing. It's just the governor's orders, and she isn't going to get many votes this year." — Linda Dobbins of Yale

Dozens of Cougar, Yale and Ariel residents were kept waiting hours Tuesday in the lobby of the Vancouver office of the state Department of Licensing as they sought permission to go home.

Several persons arrived as early as 9 a.m. to get their permits for entry into the designated "red zone" around Mount St. Helens.

THE COLUMBIAN, June 11, 1980

Excerpt X:

COUGAR — Dot and Elvin Elmire finally have relented to the wrath of Mount St. Helens and left their Cougar Store.

"Heck, without our power, we're just kind of dangling," said Mrs. Elmire, who up until this morning had chosen to stay 12 miles southwest of the capricious cone that blew sky high.

THE COLUMBIAN, June 13, 1980

Excerpt XI:

COUGAR — They sat up all night at Jack's Sporting Goods store in Cougar as pea-sized pumice fell outside. 15 defiant souls who still say they aren't afraid of erupting Mount St. Helens.

"The sheriff started to evacuate us, but it was too dangerous to drive so everybody stopped at our place." That was Jean Ragsdale who answered when The Daily News called this morning. She and her husband own Jack's Sporting Goods in Cougar, and they'd had no sleep all night.

THE DAILY NEWS, Longview, Wash., June 13, 1980

Excerpt XII:

Residents of the Cougar area, clamoring to get their towns and nearby recreation areas southwest of Mount St. Helens reopened to the public, "are hearing only what they want to hear," says an official who himself was chased out of his home and office by the volcano.

THE COLUMBIAN, June 24, 1980.

ACTIVITY I — CONCERNS

1. Cougar had some real concerns about their welfare as a community. List some of their concerns below for the following dates.

April 1 — April 18:

No tourist trade, traffic jams outside roadblocks

May 2 — May 14:

Won't pay taxes, bored by volcano, no business, loggers can't come in

May 26 — June 24:

Critical of the rescue effort, permission slips slow, people move out, solidarity of community — show no fear, need to get area reopened

2. What are concerns from the three time periods that are similar?

People want roadblocks moved.

3. Choose one concern from above. Write it below.

Answers vary

4. What do you think could be done about this problem?

Answers vary

5. Do you think the government or the city should take care of it? Why?

Answers vary

ACTIVITY II — SOLUTIONS

Role play your solutions to the problems faced by the people of Cougar. If the solution doesn't seem to work, think of another way to solve the problem.

Write below the concern you chose, whether the solution worked during role playing, and possible other solutions.

Concern:

Did the role play solve the problem? Why?

Other solutions possible:

ACTIVITY III — SITUATIONS

1. Some people decided to move out of Cougar; others decided to stay. Have two people role play following situations:

Person 1:

A. Business is gone, decides to move out in spite of savings
B. Student from Cougar who is leaving after spending all his life there.
C. Father of family wants to leave because of no business.
D. Sheriff who came to evacuate Jack's Sporting Goods Store.

Person 2:

A. Business is gone, stays in town, living on savings.
B. Student from Cougar who must be evacuated only to find hours of waiting before he can return.
C. Mother of family wants to stay despite no business.
D. A person in the store during the pumice "rain."

NAME: ______________________________ DATE: ______________

ACTIVITY I — CONCERNS

REFERENCE ARTICLES:
— "Dust driving longtime Cougar residents out," Page 21
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THE DAILY NEWS, Longview, Wash., May 14, 1980

Excerpt VIII:

Cowlitz County Sheriff Les Nelson said this morning that private search parties in the disaster area may have been caught by Sunday morning's ash fallout.

Nelson also took issue with the people who have criticized the official rescue operations as well as those involved in the private search parties.

"I understand and I sympathize with those people who

have lost loved ones, but people have to appreciate that there is a way to do these things," he said. "The people who throw a pack on their back and go in there are actually contaminating the rescue scene."

Nelson said there was some confusion among the many agencies involved in search and rescue efforts. "But you show me where they've handled a volcanic eruption better. It's not fair to criticize people who have worked this hard"

THE DAILY NEWS, Longview, Wash., May 26, 1980

Excerpt IX:

"We've already filled out waivers that we wouldn't sue the state or the county. We're just redoing the same thing. It's just the governor's orders, and she isn't going to get many votes this year." — Linda Dobbins of Yale

Dozens of Cougar, Yale and Ariel residents were kept waiting hours Tuesday in the lobby of the Vancouver office of the state Department of Licensing as they sought permission to go home.

Several persons arrived as early as 9 a.m. to get their permits for entry into the designated "red zone" around Mount St. Helens.

THE COLUMBIAN, June 11, 1980

Excerpt X:

COUGAR — Dot and Elvin Elmire finally have relented to the wrath of Mount St. Helens and left their Cougar Store.

"Heck, without our power, we're just kind of dangling," said Mrs. Elmire, who up until this morning had chosen to stay 12 miles southwest of the capricious cone that blew sky high.

THE COLUMBIAN, June 13, 1980

Excerpt XI:

COUGAR — They sat up all night at Jack's Sporting Goods store in Cougar as pea-sized pumice fell outside. 15 defiant souls who still say they aren't afraid of erupting Mount St. Helens.

"The sheriff started to evacuate us, but it was too dangerous to drive so everybody stopped at our place." That was Jean Ragsdale who answered when The Daily News called this morning. She and her husband own Jack's Sporting Goods in Cougar, and they'd had no sleep all night.

THE DAILY NEWS, Longview, Wash., June 13, 1980

Excerpt XII:

Residents of the Cougar area, clamoring to get their towns and nearby recreation areas southwest of Mount St. Helens reopened to the public, "are hearing only what they want to hear," says an official who himself was chased out of his home and office by the volcano.

THE COLUMBIAN, June 24, 1980.

1. Cougar had some real concerns about their welfare as a community. List some of their concerns below for the following dates.

April 1 — April 18:

May 2 — May 14:

May 26 — June 24:

2. What are some concerns from the three time periods that are similar?

3. Choose one concern from above. Write it below.

4. What do you think could be done about this problem?

5. Do you think the government or the city should take care of it? Why?

NAME:____ DATE:________________

ACTIVITY II — SOLUTIONS

Role play your solutions to the problems faced by the people of Cougar. If the solution doesn't seem to work, think of another way to solve the problem.

Write below the concern you chose, whether the solution worked during role playing, and possible other solutions.

Concern:

Did the role play solve the problem? Why?

Other solutions possible:

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NAME:____DATE:________________

ACTIVITY III — SITUATIONS

1. Some people decided to move out of Cougar; others decided to stay. Have two people role play following situations:

Person 1:

A. Business is gone, decides to move out in spite of savings
B. Student from Cougar who is leaving after spending all his life there.
C. Father of family wants to leave because of no business.
D. Sheriff who came to evacuate Jack's Sporting Goods Store.

Person 2:

A. Business is gone, stays in town, living on savings.
B. Student from Cougar who must be evacuated only to find hours of waiting before he can return.
C. Mother of family wants to stay despite no business.
D. A person in the store during the pumice "rain."

LEVEL INFORMATION: SS A P/I

HARRY TRUMAN — HEROIC OR FOOLHARDY?

OBJECTIVE:

After reading several articles on Harry Truman the students will participate in a class discussion and write a paper on the topic "Harry Truman, Heroic or Foolhardy?"

TEACHING SUGGESTIONS:

After reading the articles concerning Harry Truman, discuss the man, his actions and the public's reaction to him with the class. Be sure to point out that not everyone thought he was a hero.

Guide questions:

1. **Would you have stayed at Spirit Lake? Why?**
2. **Should Harry have been forced to leave? Why?**
3. **Why do you think everyone else had to leave when Harry was allowed to stay?**

ACTIVITY III

Play a number of ballads in the class — explain that ballads tell a story about a folk hero, human or not, much as Harry Truman is today. Suggested ballads are "Ode to Big Blue," "Edmund Fitzgerald" and "Miguel" By Gordon Lightfoot; "Ode to Billie Joe" by Bobbie Gentry; and "Gilgarra Mountain" by Peter, Paul and Mary." The students may wish to use existing music and read the words. This could be done as a class activity or in small groups.

HARRY TRUMAN — HEROIC OR FOOLHARDY?

REFERENCE ARTICLES:

— "Fame just so much 'hooey'," Page. 38
— " 'Copter jumps the gun, Harry stays put," Page 38
— "Harry Truman lived and died by his rules," Page 39
— "Friends remember with laughter, tears," Page 39
— "Spirit Lake always," Page 39
— "Harry Truman Lake," Page 39

PROCEDURE:

After reading the reference articles break into groups of four to five. Discuss possible answers to the following questions. The answers will be used as background for the three activities.

1. What things were important to Harry Truman?

2. Find the word "immunity" in a dictionary. Write a definition below. Harry was given immunity from the law and allowed to stay at his lodge. You have been given shots to give you immunity from some disease. List below what you are immune to.

   I'm immune to:

3. One could say Harry was dedicated to Mount St. Helens. Why?

4. Give reasons why Harry might not have told anyone the real reason he did not want to leave Mount St. Helens.

5. List the reasons Harry gave for staying. Can you justify them?

ACTIVITY I — WRITE TO HARRY TRUMAN

Some existing knowledge of letter writing is preferred, although the purpose of this activity is to take a position and support it. When you have finished discussing the questions, write a letter to Harry Truman expressing your opinion about his ultimate choice. Give reasons for your opinions. Include the ideas from the questions above. Remember to begin your letter with "Dear Mr. Truman," and close your letter, "Sincerely, (your name)"

ACTIVITY II

Ask for volunteers within the classroom. Allow the presenters time to formulate and support their opinions. Other questions concerning Harry Truman could also be discussed. For instance, should Harry have kept his cats with him? Should Spirit Lake Lodge be rebuilt?

Read the two letters on Page 39, "Harry Truman Lake" and "Spirit Lake Always." Have a panel discussion about Harry Truman. Appoint a moderator and five panel members for each side of this issue. Should the abbreviated Spirit Lake of today be renamed Harry Truman Lake?

ACTIVITY III — WRITE A BALLAD

After listening to the ballads, write one about Harry Truman, set to music if possible.

NAME: ______________________________ DATE: ______________

HARRY TRUMAN — HEROIC OR FOOLHARDY?

REFERENCE ARTICLES:

— "Fame just so much 'hooey'," Page. 38
— " 'Copter jumps the gun, Harry stays put," Page 38
— "Harry Truman lived and died by his rules," Page 39
— "Friends remember with laughter, tears," Page 39
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5. List the reasons Harry gave for staying. Can you justify them?

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ACTIVITY I — WRITE TO HARRY TRUMAN

When you have finished discussing the questions, write a letter to Harry Truman expressing your opinion about his ultimate choice. Give reasons for your opinions. Include the ideas from the questions above. Remember to begin your letter with "Dear Mr. Truman," and close your letter, "Sincerely, (your name)"

NAME:______________________________ DATE:______________

ACTIVITY II

Read the two letters on page 39, "Harry Truman Lake" and "Spirit Lake Always." Have a panel discussion about Harry Truman.

Appoint a moderator and five panel members for each side of this issue. Should the abbreviated Spirit Lake of today be renamed Harry Truman Lake?

NAME: ______________________________ DATE: ______________

ACTIVITY III — WRITE A BALLAD

After listening to the ballads, write one about Harry Truman, if possible, set to music.

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LEVEL INFORMATION: LA/SCI P/I

WHAT HAPPENED TO THE ANIMALS?

OBJECTIVES:
The students will:

1. Name the animals around Mount St. Helens and list the conditions they existed under before and after the May 18, 1980 eruption.
2. Write a story from the animal's point of view about the eruption and its effects.

TEACHING SUGGESTIONS:

1. Ask the students to read the reference articles.
2. Help the class pick one animal and lead a discussion about how its life changed after the eruption.
3. Draw three columns on the chalkboard as follows:

ERUPTION EFFECTS ON ANIMALS

Animal	Before	After

4. Help the students make lists of animals living near the mountain. Talk about what it was like before the eruption and contrast that with what it was like after the eruption.
5. Tell the students to choose one animal on the list and write a story from the point of view of the animal about what happened to it after the eruption. Tell them to include information about things such as food, shelter, young, habitat, age, physical characteristics.
6. Tell students who have written about the same animal to form a group and read other's stories. Or you may prefer to ask for volunteers to read their stories to the class — ask for stories about different animals.

WHAT HAPPENED TO THE ANIMALS?

REFERENCE ARTICLES:

— "Fish, game lost," Page 46
— "Toll of fish put at 10 million Page 46
— "Gloomy prediction . . ." Page 47
— "Timber loss wipes out home for species," Page 47
— "Bird and animal toll 1.5 million," Page 47

PROCEDURE:

1. Read the reference articles in "Mount St. Helens."
2. Participate in class discussion about the effects of the Mount St. Helens eruption on wildlife.
3. Choose one animal from the list and write a story from the point of view of the animal about what happened to it after the eruption. Include such things as food, shelter, young, habitat, age, physical characteristics.
4. Participate in a discussion of the stories.

Stories will vary. They should show much thought.

NAME:______________________________DATE:____________

WHAT HAPPENED TO THE ANIMALS?

REFERENCE ARTICLES:

— "Fish, game lost," Page 46
— "Toll of fish put at 10 million
— "Gloomy prediction . . ." Page 47
— "Timber loss wipes out home for species," Page 47
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PROCEDURE:

1. Read the reference articles in "Mount St. Helens."
2. Participate in class discussion about the effects of the Mount St. Helens eruption on wildlife.
3. Choose one animal from the list and write a story from the point of view of the animal about what happened to it after the eruption. Include such things as food, shelter, young, habitat, age, physical characteristics.
4. Participate in a discussion of the stories.

LEVEL INFORMATION: LA/SS I

JOBS OF THE PEOPLE, FOR THE PEOPLE, BY THE PEOPLE

OBJECTIVE: The students will:

1. Describe the occupations and points of view of the people connected directly or indirectly with Mount St. Helens.
2. Select one occupation and role play it, demonstrating the point of view of the occupation.

TEACHING SUGGESTIONS:

1. The students should begin to see that all the jobs including the geologists are people related.
2. Divide the class into small groups. Give each group a section of the student tabloid to read. All sections have people and their jobs described.

Here is a partial list of jobs and employers alluded to in the articles:

Seismologist
Geologists
National Guard
Federal Emergency Management Agency
State Patrol
Dept. of Ecology
Newspaper
Ham radio operators
Fire fighters
Television reporters and technicians
Pilots
Red Cross
Doctors
Port of Portland
Mental Health Center
Loggers
Sheriff's Dept.
Coroner
U.S. Forest Service

Possible categories include:

1. Federal, state, local employers
2. Mudflow, ash fall, blast etc. related work
3. On the mountain, off the mountain workers
4. Reporting the events.

You will think of others.

JOBS OF THE PEOPLE, FOR THE PEOPLE, BY THE PEOPLE

ACTIVITY — JOBS

1. Individually read the section of "Mount St. Helens" assigned to your group, then do steps 2 through 5 as a group.
2. Make a list of the people associated directly or indirectly with the eruption of Mount St. Helens. List their exact job and their employers, where possible. Be as specific as possible.
3. Categorize your list in some way (by kind of job or by employer, for instance).
4. Make another list of the things all the jobs have in common.
5. Choose one of the categories you identified in Step 3. Describe all the job holders in that category by filling in the chart on Worksheet 1.
6. Individually, select one person on the chart you would like to interview. Write a list of questions you would ask this person if you could. Prepare your interview on the form below:

A review of the 5 Ws and H might be helpful here.

ACTIVITY II — ROLE PLAY

PROCEDURE:

1. In your group, list two or more job roles on Worksheet 2 that especially interest you and that you think are well described. Complete Worksheet 2 by listing the similarities and differences of the jobs, and by stating the attitude each has toward disaster.
2. For five minutes, brainstorm situations in which the jobholders have an interaction.
3. Choose one situation discussed in Step 2 to role play for the class. If the points of view of the roles being played are different the role play may be more interesting.

NAME: ____________________ DATE: ____________

JOBS OF THE PEOPLE, FOR THE PEOPLE, BY THE PEOPLE

ACTIVITY I — JOBS

1. Individually read the section of "Mount St. Helens" assigned to your group, then do steps 2 through 5 as a group.
2. Make a list of the people associated directly or indirectly with the eruption of Mount St. Helens. List their exact job and their employers, where possible. Be as specific as possible.
3. Categorize your list in some way (by kind of job or by employer, for instance).
4. Make another list of the things all the jobs have in common.
5. Choose one of the categories you identified in Step 3. Describe all the job holders in that category by filling in the chart on Worksheet 1.
6. Individually, select one person on the chart you would like to interview. Write a list of questions you would ask this person if you could. Prepare your interview on the form below:

Person: ____________________

Job: ____________________ Employer: ____________________

Questions:

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

NAME: ____________________ DATE: ____________

WORKSHEET No. 1

CATEGORY: ____________________

EMPLOYER	JOB	DESCRIPTION	POINT OF VIEW OF THE JOBHOLDER

NAME:____ DATE:______________

GROUP:______________________

ACTIVITY II — ROLE PLAY

PROCEDURE:

1. In your group, list two or more job roles on Worksheet 2 that especially interest you and that you think are well described. Complete Worksheet 2 by listing the similarities and differences of the jobs, and by stating the attitude each has toward disaster.
2. For five minutes, brainstorm situations in which the jobholders have an interaction.
3. Choose one situation discussed in Step 2 to role play for the class. If the points of view of the roles being played are different the role play may be more interesting.

NAME: ______________________________ DATE: ______________

WORKSHEET No. 2:

JOBS PEOPLE HAVE

JOBS	HOW ALIKE	HOW DIFFERENT	ATTITUDE TOWARD DISASTER

AFTER THE HOLOCAUST — WHAT THEN?

OBJECTIVE:

The student will search "Mount St. Helens" for supporting facts to write a paragraph summarizing the effects of the Mount St. Helens eruption on a student-selected aspect of nature.

TEACHING SUGGESTIONS:

1. The activity may be done individually or by pairs of students.
2. There are five tasks to be completed in the activity.
   a. Select a topic
   b. Search "Mount St. Helens" for information on the topic.
   c. Make notes of the information to be used in writing the paper, or underline the facts to be used.
   d. Organize the facts to be used in the paper
   e. Write the paper
3. Help the students compare the tasks in the activity.
4. The students may need some extra help in identifying and recording facts they want to use in writing their articles. They also may need some encouragement to skim the articles instead of reading the article in its entirety. You may want to provide guidelines for scanning, underlining and note taking. You may also want to review the difference between a fact and an opinion.

AFTER THE HOLOCAUST — WHAT THEN?

REFERENCE ARTICLES:

— Selected by the student from the "Mount St. Helens" tabloid.

PROCEDURE:

1. Select a topic from the list below that is of interest to your and that you would like to write about.
   - Forests
   - Wildlife and fish
   - Waterways and lakes
   - Health of people/mental and physical
   - Effects on people who live in or near Toutle
2. Search through your copy of "Mount St. Helens" to find articles about the effects of the volcano on the topic you selected.
3. Scan the articles you found to identify facts concerning the effects of the eruption on your topic. Write down the facts.
4. Decide which facts you want to use in your paper. Set the other facts aside — you may decide to use some of them as you start writing.
5. Organize your notes into a basic outline for your paper. You may want to use the following headings:
   a. The damage done.
   b. The recovery period.
   c. Anticipated future problems.
   d. Various opinions, such as: whether man should interfere to help; whether nature should be allowed to take its course; what is helpful or not helpful; or what will block recovery.
6. Write the paper, including an introduction, the main facts and a conclusion.

EXTENDED ACTIVITY:

Form a group with others in the class who wrote about the same topic. Share your papers. Discuss different facts you used, why you selected some facts and not others, how your papers are similar.

NAME:____ DATE:________________

AFTER THE HOLOCAUST — WHAT THEN?

REFERENCE ARTICLES:
— Selected by the student from the "Mount St. Helens" tabloid

PROCEDURE:

1. Select a topic from the list below that is of interest to your and that you would like to write about.
   - Forests
   - Wildlife and fish
   - Waterways and lakes
   - Health of people/mental and physical
   - Effects on people who live in or near Toutle

2. Search through your copy of "Mount St. Helens" to find articles about the effects of the volcano on the topic you selected.

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NAME: ______________________________ DATE: ______________

EXTENDED ACTIVITY:

Form a group with others in the class who wrote about the same topic. Share your papers. Discuss different facts you used, why you selected some facts and not others, how your papers are similar.

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HEARING THINGS

OBJECTIVES:

The students will:

1. Demonstrate their ability to recognize objects in pictures with the same initial sounds and ending sounds.
2. Demonstrate their ability to hear rhyming words.

TEACHING SUGGESTIONS:

1. Mount pictures containing a variety of initial sounds and ending sounds on tagboard.
2. Direct individuals or groups of students to point to objects in the pictures that begin with the same sound.
3. Ask individual students to point to items in the pictures and give the initial sounds.
4. Have individual students point to objects in the pictures that rhyme with a word the teacher pronounces.
5. Instruct students to cut out objects in their Student Tabloid that rhyme. Help them make a booklet of these objects, using white or colored paper.

LEVEL INFORMATION: LA P/I

SIMILE: IT'S LIKE, OR IT'S THE SAME AS . . .

OBJECTIVE:

Students will focus on vocabulary words related to the volcano by doing the activity prescribed.

TEACHING SUGGESTIONS:

1. Explain similes to the class. Use one or two words from the vocabulary list in the activity sheet to illustrate your explanation.

2. Tell the students to write similes for five of the words on the list. (Options: With younger students transfer the chart to the chalkboard, chart or butcher paper. Write answers dictated by the students on the chart.)

3. Help the student incorporate three of their five similes into a story. Either ask students to share their stories in class or form small groups in which they read their stories to each other.

IT'S LIKE, OR IT'S THE SAME AS . . .

REFERENCE ARTICLES:

— "Glossary of Volcanic Terms," Page 51

MATERIALS:

Dictionary

PROCEDURE:

1. Participate in a class discussion about similes.

2. Write a simile for five of the volcanic words in the list below. Get help from your dictionary and from the Glossary on page 51 of the Student Tabloid.

Volcanic	Simile
Cone	
Core	
Crater	
Crust	
Debris	
Deposit	
Dislodge	
Earthquake	
Eruption	
Fissure	
Fumarole	
Glowing ash	
Juvenile ash	
Lateral	
Lava flows	
Magma	
Mantle	
Molten	
Mudflow	
Pressure	
Pumice	
Pyroclastic	
Sequence	
Summit	
Vent	
Volcano	

3. Write a story. Include three of your volcano word similes in the story.

4. Share your stories in class.

NAME: ______________________________ DATE: ______________

SIMILE: IT'S LIKE, OR IT'S THE SAME AS . . .

REFERENCE ARTICLES:
— "Glossary of Volcanic Terms," Page 51

MATERIALS:
Dictionary

PROCEDURE:

1. Participate in a class discussion about similes.

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Volcanic	Simile
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Eruption	
Fissure	
Fumarole	
Glowing ash	
Juvenile ash	
Lateral	
Lava flows	
Magma	
Mantle	
Molten	
Mudflow	
Pressure	
Pumice	
Pyroclastic	
Sequence	
Summit	
Vent	
Volcano	

3. Write a story. Include three of your volcano word similes in the story.

4. Share your stories in class.

LEVEL INFORMATION: LA I

HOW DOES IT LOOK TO YOU?

OBJECTIVE: The students will write a descriptive paragraph or paragraphs based on reading articles chosen from "Mount St. Helens."

TEACHING SUGGESTIONS:

1. Help the class select four or five articles from the reference articles List and ask the students to read them.
2. Help the students list on the chalkboard, butcher paper or chart all the words in the articles they can remember that describe the mountain. Encourage them to think of additional adjectives. Another method which may be helpful is to fill in a chart (see example below).

Kind of word	Nouns	Verbs	Adjectives	Adverbs
Feeling words	1. Queen of the Cascades 2. Harmony Forest 3. Spirit Lake 4. Victim	Evacuated	exciting hurting cantankerous	
Sight Words	1. Picture postcards 2. Snow-capped peak 3. Cracks	shakes	gray and dark	
Sound Words	1. Echo	rumbles boom	loud	Softly

3. Tell the students to use the words they listed as the basis for a paragraph that describes:
   - how they feel about the mountain, or
   - how they think the mountain looks, or
   - how they think the eruptions and earthquakes sounded.

You and the class may think of other ideas for description.

4. Ask the students to share their paragraphs. Conduct a discussion about the great variety of ways in which Mount St. Helens can be described.

HOW DOES IT LOOK TO YOU?

REFERENCE ARTICLES:
- — Poem, Page 14
- — "Beautiful valley now desolate wasteland," Page 18
- — "Scientists study effects of ash closely," Page 19
- — "Dust driving longtime Cougar residents out," Page 21
- — "St. Helens viewpoint needed," Page 25
- — "Humor high despite trials and hardships," Page 33
- — "Scientists watch dome for lava flow," Page 34
- — "Times 33: Guatemalans have learned to live with 33 volcanoes," Page 37
- — "Couple struggle for life," Page 40
- — "Volcano drills for students," Page 40
- — "Searching: Helicopters comb 'hell on earth' to find survivors," Page 41
- — "Cougar residents flee," Page 45
- — "Timber loss wipes out home for species," Page 47

PROCEDURE:

1. Participate in the selection of four or five stories from the reference articles and read the article chosen.

2. Contribute to the listing of words that describe Mount St. Helens. Offer words you remember from the articles, as well as other words you believe describe Mount St. Helens.

3. Write a paragraph about Mount St. Helens, using the list of words as a basis to:

- describe how you feel about the mountain, or
- how you think the mountain looks, or
- how you think the earthquakes and eruptions sounded.

Your class may list other topics. Write your paragraphs about only one of the topics.

4. Be ready to share your paragraph with others. Discuss ways in which your paragraphs are different from each other.

NAME: ______________________________ DATE: ______________

HOW DOES IT LOOK TO YOU?

REFERENCE ARTICLES:

- — Poem, Page 14
- — "Beautiful valley now desolate wasteland," Page 18
- — "Scientists study effects of ash closely," Page 19
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1. Participate in the selection of four or five stories from the reference articles and read the article chosen.
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   - describe how you feel about the mountain, or
   - how you think the mountain looks, or
   - how you think the earthquakes and eruptions sounded.

Your class may list other topics. Write your paragraphs about only one of the topics.

4. Be ready to share your paragraph with others. Discuss ways in which your paragraphs are different from each other.

LEVEL INFORMATION: LA I

MUDFLOW POETRY

OBJECTIVE:
The students will write a poem using descriptive verbs, and adjectives.

TEACHING SUGGESTIONS:

1. This activity may be done by individuals or in any size group.
2. If the activity is done in a large group the words on individual worksheets should be the ones they like best from a group brainstorming activity.

After reading the reference articles and studying the photo listed in the reference section:

3. Brainstorm lists of nouns, verbs and adjectives.
4. Tell the students to work as a group to select combinations of words.
5. Write them on the board as sentences or phrases.
6. Continue this process by circling other words and combining them. Then write them on the board.
7. When the group has five or six sentences or phrases, ask the group to edit what they have written. Ask — are there repetitions? Do the words need to be more specific?
8. Help the students suggest changes and write them on the board.
9. When you and the students are satisfied with the poem, leave it on the board as a model and then ask the students to write their own. They may use the words on the board in new combinations and/or add new words of their own.
10. Make a classroom book of the poems created.

MUDFLOW POETRY

REFERENCE ARTICLES:
— "Ominous, eerie hush falls," Page 28
— "Tragedy's Toll . . .," Page 30
— Photo, Cowlitz and Toutle rivers, Page 29
— Photo, under mud, Page 29
— Rampage, Page 27

PROCEDURE:

1. Read the articles and study the photos listed in the reference section.

2. List nouns associated with mudflows (e.g. trees, blossoms).

3. List active verbs associated with mudflows (e.g. chokes, destroys).

4. List adjectives associated with mudflows (e.g. green, growing)

5. Participate in the group to write a class poem, by combining two words from each list into lines. For example,

Mud oozes around the trees and blossoms.
Chokes and destroys
What once was green and growing.

6. Write your own poem. Select the words you like best from the lists. Try to describe sounds, smells and touch as well as sight. What would you hear, smell, touch and taste, as well as see, in a mudflow?

7. Prepare your poem to put in the classroom book. You may want to illustrate your poem with a drawing or picture cut from a paper or magazine.

NAME: ______________________________ DATE: ______________

MUDFLOW POETRY

REFERENCE ARTICLES:
- "Ominous, eerie hush falls," Page 28
- "Tragedy's Toll . . .," Page 30
- Photo, Cowlitz and Toutle rivers, Page 29
- Photo, under mud, Page 29
- Rampage, Page 27

PROCEDURE:

1. Read the articles and study the photos listed in the reference section.

2. List nouns associated with mudflows (e.g. trees, blossoms).

3. List active verbs associated with mudflows (e.g. chokes, destroys).

4. List adjectives associated with mudflows (e.g. green, growing)

5. Participate in the group to write a class poem, by combining two words from each list into lines. For example,

Mud oozes around the trees and blossoms.
Chokes and destroys
What once was green and growing.

6. Write your own poem. Select the words you like best from the lists. Try to describe sounds, smells and touch as well as sight. What would you hear, smell, touch and taste, as well as see, in a mudflow?

7. Prepare your poem to put in the classroom book. You may want to illustrate your poem with a drawing or picture cut from a paper or magazine.

WRITE A STORY

OBJECTIVE:

The students will dictate to a teacher or aide a descriptive story based on pictures chosen from the Student Tabloid.

TEACHING SUGGESTIONS:

1. Have the whole class select a picture from the Student Tabloid.
2. Ask the students to list all the words the picture makes them think of. Write these words on a chalkboard, butcher paper or chart. (The teacher or aide can do this.)
3. Ask the students to describe what type of story they would like to write (scary, funny, serious)
4. Tell each student to make up one sentence about the picture, using the words from their list. Tell the students to read their sentence. Record them on chalkboard, butcher paper or chart.
5. Using the sentences and words just recorded, ask each student to dictate part of a story to the teacher or aide about the picture. Record the story on butcher paper or chart.
6. As students dictate their parts be sure to help them relate to the story structure, plot and style. This can be done by:
    a. Rereading story aloud several times as writing is being done.
    b. Questioning students as to the "sense" and organization of their sentences and perhaps helping them reword.
7. Display the finished story with the picture. Students can be asked to read it aloud for several days following the activity.

EXTENDED ACTIVITY:

Direct the students to follow the same procedure individually. Ask them to read their stories to each other.

FEATURE STORY

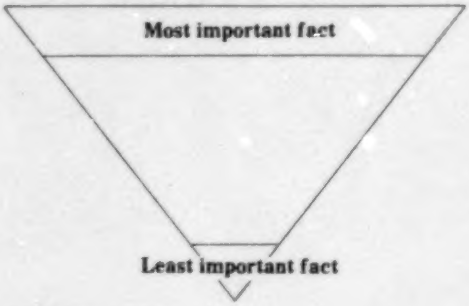
OBJECTIVES:
The students will:

1. **Differentiate between a feature story and other types of news stories.**
2. **Write a feature story with introduction, body and conclusion.**
3. **Recognize the five Ws and H in a feature story.**

TEACHER BACKGROUND:
Feature stories differ from news stories in focus. Feature articles include:

- a. **Human interest stories.**
- b. **Articles connected to a straight news item.**
- c. **Special information articles and regular columns.**
- d. **Articles with potential reader interest but not of immediate news importance.**
- e. **Feature articles can be in any style of writing the author prefers, but it will have an introduction, a body, and a conclusion. It will be written in short paragraphs, and it will contain the five Ws and the H. The feature story does not necessarily follow the inverted pyramid form of a straight news story.** **News stories include:**
- a. **Straight news written in an inverted pyramid style.**

Inverted pyramid style of straight news story



- b. **All the important facts of the story — who, what, when, where and how — in the first, or lead, paragraph.**

TEACHING SUGGESTIONS:

1. **Each of the activities emphasizes a different aspect of journalistic writing.**
2. **Help the students complete activities I and II.**
3. **When activities I and II are complete, ask the students to read "Ash Army" on Page 25 and "Steamy peak . . ." on Page 10.**
4. **Conduct a discussion about what differentiates the feature article ("Ash Army") from the straight news article ("Steamy Peak"). They should be able to discriminate with criteria similar to those mentioned in the teacher background section above.**

ACTIVITY I — FEATURE STORY

REFERENCE ARTICLES:

— "Pregnant part-poodle rescued . . .," Page 40
— ". . . Mom and pups OK," Page 40
— Photo, "Mother and children doing fine," Page 40
— "Couple struggle for life," Page 40

PROCEDURE:

1. Read the feature stories on Page 40 of "Mount St. Helens."
2. List the "how" or "when" words from one of the article below.

Answers will vary

3. List the "what" words from the same article.

Answers will vary

4. In the feature stories you just read, what did the people featured have in common? How were they different?

Answers will vary

5. Why do you think these people were chosen for a feature article?

Answers will vary

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ACTIVITY II — FEATURE STORY

PROCEDURE:

1. Copy three headlines from pages 23-27 of "Mount St. Helens."
   a.
   b.
   c.

2. Could you infer what each story was about by reading the headline?

Students should answer "yes."

3. Why do news stories have headlines?

To tell main idea of articles and attract attention.

4. Write an original headline for one of the stories emphasizing the following:

"Who:"

"What:"

"When:"

"Where"

"Why"

Answers will vary.

5. What type of verb appears in most headlines?

Active

6. Where do the facts for a headline usually originate?

In the lead paragraph.

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ACTIVITY III — WRITING A FEATURE STORY

1. Put yourself in the role of interviewers. Choose one person from "Mount St. Helens" — a mudflow or ashfall victim — to interview. Make a list of questions you would ask that person. Be sure questions deal with the 5 Ws and How.

Answers will very, but include 5 Ws and H.

2. Pick a "hard news" story from the "Mount St. Helens" tabloid. Invent a feature story from its ideas. Be sure to include a headline, introduction, body and conclusion.

Stories will vary but include headline, introduction, body and conclusion.

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NAME: ______________________________ DATE: ______________

FEATURE STORY — ACTIVITY I

REFERENCE ARTICLES:

- "Pregnant part-poodle rescued . . .," Page 40
- ". . . Mom and pups OK," Page 40
- Photo, "Mother and children doing fine," Page 40
- "Couple struggle for life," Page 40

PROCEDURE:

1. Read the feature stories on Page 40 of "Mount St. Helens."

2. List below the "how" or "when" words from one of the articles.

3. List the "what" words from the same article.

4. In the feature stories you just read, what did the people featured have in common? How were they different?

5. Why do you think these people were chosen for a feature article?

NAME: ______________________________ DATE: ______________

FEATURE STORY — ACTIVITY II

PROCEDURE:

1. Copy three headlines from pages 23-27 of "Mount St. Helens."

   a.

   b.

   c.

2. Could you infer what each story was about by reading the headline?

3. Why do news stories have headlines?

4. Write an original headline for one of the stories emphasizing the following:

   "Who:"

   "What:"

   "When:"

   "Where"

   "Why"

5. What type of verb appears in most headlines?

6. Where do the facts for a headline usually originate?

NAME: ______________________________ DATE: ______________

ACTIVITY III — WRITING A FEATURE STORY

1. Put yourself in the role of an interviewer. Choose one person from "Mount St. Helens" — a mudflow or ashfall victim — to interview. Make a list of questions you would ask that person. Be sure questions deal with the 5 Ws and How.

2. Pick a "hard news" story from the tabloid. Invent a feature story from its ideas. Be sure to include a headline, introduction, body and conclusion.

LEVEL INFORMATION: LA I

EDITORIAL RESPONSE

OBJECTIVE:

The students will write a letter responding to an editorial or letter to the editor.

TEACHING SUGGESTIONS:

1. **Tell the students to read the articles.**
2. **Discuss the points made by the articles with the class.**
3. **Brainstorm several points of view related to the articles.**
4. **Tell the students to select one of the articles and write a reply. Emphasize the response should be in first person (review if necessary).**

EDITORIAL RESPONSE

REFERENCE ARTICLES:

- "Will goddess stay angry? Time will tell," Page 5
- "Dust driving longtime Cougar residents out," Page 21
- Editorial: "St. Helens viewpoint needed," Page 25
- "Effort confused at times," Page 33
- Spirit Lake Always, p. 39
- "No place like home," Page 44

PROCEDURE:

1. Read the reference articles in "Mount St. Helens."
2. Participate in a class discussion about the articles and other possible points of view.
3. Write a letter replying to one of the articles. Write your letter in first person.

TEACHER BACKGROUND: WRITING A BUSINESS LETTER:

The following is a suggested form for a business letter. Each part is defined at the left.

Heading: Writer's complete address and the date. Commas are needed only between city and state, and the day of the month and the year.

Inside address: Complete name and address of person or organization you are writing to.

Salutation: In a business letter, the salutation is followed by a colon. You may address the letter to an individual when you know their name, otherwise address by title.

Body: State what you want to say in a brief, clear and complete manner. Be neat.

Closing: Only the first word is capitalized.

Signature: Even on a typed letter, your name should be written in.

8240 N.E. 72nd St.
Vancouver, Wash. 98663
August 16, 1980

Crater Parts Company
44 Oval Circle
Round Place, Washington 98808

Dear Sir:

Please send me, by parcel post, the following items as mentioned in your advertisement.

1 bottle of volcanic ash
2 Mount St. Helens T shirts

I am enclosing a money order for $3.75, plus $.50 to cover postage, a total of $4.25.

Yours truly,

Harold M. Ogle

LEVEL INFORMATION: LA/SS I

TAKE A STAND!

OBJECTIVE:

The students will take a stand and defend it accurately.

TEACHING SUGGESTIONS:

1. Tell the students to read the reference articles in "Mount St. Helens."
2. Discuss advocacy with the students. Include as many illustrations of well-supported advocacy as you can. Include examples of editorials in the discussion.
3. Guide the students in their selection of a question on which they want to defend their position (See activity sheet for questions).
4. Tell the students to write their paper in an editorial format. Review editorial format as needed.
5. Form small groups by asking students who wrote papers on the same question to join for a discussion. Tell them to share their papers, identifying and discussing differences and similarities in their positions.

TAKE A STAND!

REFERENCE ARTICLES

— 'Copter jumps gun, — Harry stays put," Page 38
— "Two face charges following rescue," Page 43
— "FAA patrols sky near peak," Page 43
— "Lessons learned," Page 36.

PROCEDURE:

1. Read the reference articles in "Mount St. Helens."
2. Participate in class discussion about taking and defending a position regarding an issue. This is called "advocacy."
3. Select one of the following questions about which you have a position you are prepared to defend:
   a. Should government agencies have closed the area around Mount St. Helens?
   b. Should government agencies have enforced the Mount St. Helens closed area more strictly than they did?
   c. Should people have been allowed into the closed area at their own risk?
   c. Should planes be allowed to fly over the Mount St. Helens crater?
   d. Should Harry Truman have been forced to leave his lodge?
4. Write a paper defending your position regarding the question you selected.
5. Participate in a discussion of your position paper with others who took a position on the same question.

NAME: ______________________________ DATE: ______________

TAKE A STAND!

REFERENCE ARTICLES
- " 'Copter jumps gun, Harry stays put," Page 38
- "Two face charges following rescue," Page 43
- "FAA patrols sky near peak," Page 43
- "Lessons learned," Page 36.

PROCEDURE:

1. Read the reference articles in "Mount St. Helens."

2. Participate in class discussion about taking and defending a position regarding an issue. This is called "advocacy."

3. Select one of the following questions about which you have a position you are prepared to defend:
   a. Should government agencies have closed the area around Mount St. Helens?
   b. Should government agencies have enforced the Mount St. Helens closed area more strictly than they did?
   c. Should people have been allowed into the closed area at their own risk?
   c. Should planes be allowed to fly over the Mount St. Helens crater?
   d. Should Harry Truman have been forced to leave his lodge?

4. Write a paper defending your position regarding the question you selected.

5. Participate in a discussion of your position paper with others who took a position on the same question.

BOOM TO BOON

OBJECTIVES:

The students will:

1. List ways the Mount St. Helens eruption is being used for commercial gain.
2. Analyze a news article to determine approach being used to sell the produce.
3. Create an ad campaign for a Mount St. Helens related product.

TEACHING SUGGESTIONS:

1. Present various advertising devices to the class. Explain that this is often how newpapers are sold.
2. Help the students complete Steps 1-5 on the Activity Sheet.
3. Explain that entrepeneurs (one who organizes, manages and assumes the risks of a business or enterprise) use many approaches to people in their efforts to sell their product. These include:
   - a. Purposeful distortion.
   - b. Ambiguity — suggesting much, saying little
   - c. Appeal — desire to be strong, desire to be attractive, desire to be up-to-date.
   - d. Emotion — fear, hope, grief.
   - e. Cherished values — the good, the true, the beautiful
   - f. Name calling — Yankee, Rebel, Sissy
   - g. Glittering generalities — religious, science, brotherhood.

List the approaches on the chalkboard.

4. Ask the students to analyze one of the news articles listed to determine which of the above approaches they can discover. If none of these approaches apply, see if the class can identify another approach to add to the list. (Step 6 on the activity sheet).
5. Help the students prepare an advertising promotional campaign for the State of Washington to show that it has not been devastated by Mount St. Helens (Step 7 on the activity sheet).

BOOM TO BOON

REFERENCE ARTICLES:

— "Volcano gives rise to a business boom," Page 49
— "A bumper crop of stickers," Page 49
— "T-shirts, T-shirts, still more T-shirts," Page 49
— "Some people find ash has some use after all," Page 49
— Photo, assorted St. Helens items, Page 49

PROCEDURE:

1. Read the "business boom" articles on Page 49 of "Mount St. Helens." Make a list, in the two listed categories, of the ways entrepreneurs have made money from the eruption.

Materials Sold Directly from Mountain	Materials Sold Indirectly from Mountain	
Airlines	T-Shirts	calendar
cleanser	post cards	face mask
ashtray	posters	records
pendant	books	bumper stickers

2. List other ways to make money using ash or using non-volcanic material. For example, plaster of Paris volcanoes, painted and labeled. If there is time, draw a picture or make an example of your products you like best.

Answers vary

3. What items are available in your area that are comparable to the Mount St. Helens items?

Answers vary

a. Are the features you've listed unique to your area? If no, where else could they be found?

Answers vary

4. List any other items you feel your area could sell. If there is time, draw a picture or perhaps bring a model to display.

Answers vary

5. Do you think the items you have listed in Question 3 are intended mainly for the resident population or for tourists? Why?

Answers will vary

6. Select one of the articles in the reference articles list. Which of the selling approaches listed on the chalkboard do you think is used? If none of the approaches apply, what approach do you think is being used?

Answers will vary.

7. Create an ad campaign for the state of Washington to show that it has not been devastated by the eruption of Mount St. Helens. Here are a few suggestions.

   a. Think of the type(s) of media you want to use, i.e. radio, TV, news, magazine.
   b. Consider the potential receivers of your campaign.
   c. Check out the costs of advertising in your media choices vs. the cost of production.
   d. Decide where your campaign will be carried out.

Your ad campaign should include the following:

   a. The cost of production.
   b. The cost of the media exposures.
   c. A makeup of your ad(s).
   d. Duration of exposure.
   e. Area of geographic exposure.

NAME: ______________________________ DATE: ______________

BOOM TO BOON

REFERENCE ARTICLES:

- "Volcano gives rise to a business boom," Page 49
- "A bumper crop of stickers," Page 49
- "T-shirts, T-shirts, still more T-shirts," Page 49
- "Some people find ash has some use after all," Page 49
- Photo, assorted St. Helens items, Page 49

PROCEDURE:

1. Read the "business boom" articles on Page 49 of "Mount St. Helens." Make a list, in the two listed categories, of the ways entrepreneurs have made money from the eruption.

Materials Sold Directly from Mountain	Materials Sold Indirectly from Mountain

2. List other ways to make money using ash or using non-volcanic material. For example, plaster of Paris volcanoes, painted and labeled. If there is time, draw a picture or make an example of your products you like best.

3. What items are available in your area that are comparable to the Mount St. Helens items?

Are the features you've listed unique to your area? If no, where else could they be found?

4. List any other items you feel your area could sell. If there is time, draw a picture or perhaps bring a model to display.

5. Do you think the items you have listed in Question 3 are intended mainly for the resident population or for tourists? Why?

6. Select one of the articles in the reference articles list. Which of the selling approaches listed on the chalkboard do you think is used? If none of the approaches apply, what approach do you think is being used?

7. Create an ad campaign for the state of Washington to show that it has not been devastated by the eruption of Mount St. Helens. Here are a few suggestions.
   a. Think of the type(s) of media you want to use, i.e. radio, TV, news, magazine.
   b. Consider the potential receivers of your campaign.
   c. Check out the costs of advertising in your media choices vs. the cost of production.
   d. Decide where your campaign will be carried out.

Your ad campaign should include the following:
   a. The cost of production.
   b. The cost of the media exposures.
   c. A makeup of your ad(s).
   d. Duration of exposure.
   e. Area of geographic exposure.

LEVEL INFORMATION: LA/SS I

"IT'S YOUR OPINION THAT . . ."

OBJECTIVE:

The students will analyze an editorial or other opinionated personal writing.

TEACHER BACKGROUND:

Editorials can be read analytically with the reader asking:

1. Is the editorial written in language everyone can understand, or is it written for a group of people with specialized knowledge?
2. Is the editorial filled with long, hard words that make it difficult for the average person to understand, or is the language designed to fit the needs of a particular group.
3. Is the editorial based on fact, even though it presents an opinion?

TEACHING SUGGESTIONS:

1. Help the students find one or two articles in the Student Tabloid that reveal the opinions of the writer.
2. Tell the students to underscore the sentences in the articles that contain the writer's opinion.
3. Tell them to analyze the sentences they have underscored according to the following criteria:
   a. Editorials must be written in a language everyone can understand, not in a specialized language only a few can understand.
   b. Editorials must be based on fact, even though they represent an opinion.

"IT'S YOUR OPINION THAT . . ."

REFERENCE ARTICLES:

— Selected by the students

PROCEDURE:

1. Select one or two articles from "Mount St. Helens" that reveal the opinion of the writer.

A viewpoint is needed.

2. Underscore the sentences in the articles that contain the writer's opinion.

Answers will vary.

3. Analyze the articles by applying the following guidelines:
   a. Everyone needs to understand the language; not just a few people with special knowledge.
   b. The words must be easily understood; there should not be many long, hard words that are not explained.
   c. The article should be based on facts, even though the writer has an opinion about those facts.

4. Participate in a class discussion of your analysis.
   a. Be prepared to give reasons for your analysis.
   b. Editorial language must contain words easily understood by the people who read the articles. They should not be filled with long, hard words difficult for the average person to read.
   c. Editorials should be based on fact, even though they represent an opinion.

4. Conduct a discussion of the analyses the students have made. Emphasize the three criteria they have just applied to their analysis.

NAME: ____ DATE: ________________

"IT'S YOUR OPINION THAT . . ."

REFERENCE ARTICLES:

— Selected by the students

PROCEDURE:

1. Select one or two articles from "Mount St. Helens" that reveal the opinion of the writer.

2. Underscore the sentences in the articles that contain the writer's opinion.

3. Analyze the articles by applying the following guidelines:
   a. Everyone needs to understand the language; not just a few people with special knowledge.
   b. The words must be easily understood; there should not be many long, hard words that are not explained.
   c. The article should be based on facts, even though the writer has an opinion about those facts.

4. Participate in a class discussion of your analysis.
   a. Be prepared to give reasons for your analysis.
   b. Editorial language must contain words easily understood by the people who read the articles. They should not be filled with long, hard words difficult for the average person to read.
   c. Editorials should be based on fact, even though they represent an opinion.

4. Conduct a discussion of the analyses the students have made. Emphasize the three criteria they have just applied to their analysis.

APPENDIX 1 — METRICS

METRIC UNITS

To measure:	Name of unit	Symbol
Length	metre	m
mass (weight)	kilogram	kg

GREEK decimal value	name	symbol	LATIN decimal value	name	symbol
$10^1 = 10$	deca	da	$10^{-1} = .1$	deci-	d
			$10^{-2} = .01$	centi-	c
$10^3 = 1,000$	kilo-	k	$10^{-3} = .001$	milli-	m
			10^{-6}	micro-	u

LINEAR — THE METRE (m)

Use of metric prefix	
millimetre	0.001m = 1mm
centimetre	0.01m = 1cm
decimetre	0.1m = 1dm*
metre	1m = 1m
kilometre	1,000m = 1km

*(not commonly used)

MASS — THE GRAM (g)

milligram	0.001g = 1mg
centigram	0.01g = 1 cg*
decigram	0.1g = 1 dg*
gram	1g = 1g

*(not commonly used)

VOLUME — THE LITRE (*l*)

millilitre	0.001*l* = 1m*l*
centilitre	0.01*l* = 1c*l*
decilitre	0.1*l* = 1d*l**
litre	1*l* = 1*l*

*(not commonly used)

CONVERSION FACTORS

U.S. customary to metric (approximate)

LENGTH:

1 inch = 25.4mm (exact)
1 foot = 304.8mm (exact)
1 yard = 0.9144m (exact)
1 mile = 1.609km

AREA:

1 square inch = 6.452cm²
1 square foot = 0.0929m²
1 square yard = 0.8361m²
1 square mile = 2.590km²

TEMPERATURE:

$\frac{F.-32}{1.8}$ = degrees Celsius

VOLUME:

1 cubic inch = 16.39cm³
1 cubic foot = 0.0283m³
1 cubic yard = 0.7646 m³
1 fluid ounce = 29.75ml
1 fluid quart = 0.946*l*
1 gallon = 3.785*l*

MASS:

1 ounce (av) = 28.35g
1 pound (av) = 0.4536kg
1 ton (2,000 lbs.) = 0.972t

VELOCITY:

$1 \text{ mph} = \left[\begin{array}{r} 0.447\text{m/s} \\ 1.609\text{km/h} \end{array} \right.$

*Adapted from Metric Measurement: A Handbook For Educators, State of Washington Superintendent of Public Instruction, Revised January 1978.

To convert English units to metric units, multiply by the conversion factor.

To convert metric to English units, divide by the conversion factor. Converting from metric to English units should be avoided. When making conversions, use the conversion factor as given and round the result, so it does not imply a greater degree of precision than existed in the original value.

EXAMPLE: To convert 7 inches to millimetres — 7 x 25.4 = 177.8mm rounded to 178mm or 180mm, depending on precision on original value.

APPENDIX II

TABLE 1, TOUTLE RIVER NEAR CASTLE ROCK

	April 22	May 21		May 27	June 23	HISTORICAL DATE		
	SW Run	11:30	17:30	SW Run	SW Run	Minimum Value	Mean Value	Maximum Value
Flow (cfs)363.00	2818.28							25,000.00
Temperature (Celsius)	9.0	11.4	13.8	10.0	15.6	1.20	9.95	21.20
Dissolved Oxygen (mg)	11.9			9.9	9.5	8.90	11.72	14.30
D.O. (percent saturation)	101.6			86.5	94.5	92.80	102.76	111.90
pH (S.U.)	7.5	7.5	6.2	7.4	7.7	6.40	7.30	7.90
Spec. Cond. (?mhos m)	36	295	290	290	150	29.00	54.60	112.00
COD (mg/l)		190	110					
Fecal Coliform (/100ml)	3	**	**	**	>800	1.00	8.77	130.00
Color	29			570	110	4.00	31.28	92.00
Turbidity (NTU's)	4	2500	2200	1600	260	1.00	10.97	220.00
Total Solids (mg/l)		10,000	8100					
TNVS (mg/l)		9700	7900					
TSS (mg/l)	7	9800	8200	7100	3100	2.00	32.65	480.00
TNVSS (mg/l)		9600	8000					
Unionized NH_3 percent	0.542	0.722		0.51		0.056	0.577	3.016
Unionized NH_3 (mg/1)	0.00	0.000		0.002		0.000	0.000	0.002
Total NH_3-N (mg/1)	0.03	0.03	0.03	0.43		0.00	0.05	0.37
NO_2-N (mg/1)		0.01	0.0			0.00	0.00	0.0[illegible]
NO_3 O_2-N (mg/1)		0.05	0.06			0.01	0.12	0.40
NO_3 O_3N (MG/1)	0.19	0.06	0.06	0.01		0.01	0.08	5.40
O-PO_4-P (mg/1)0.01	0.02	0.05	0.02		0.00	0.01		0.06
T-PO_4-P (mg/1)	0.03	0.16	0.07	5.4		0.01	0.05	0.44
Total Alkalinity (mg/l as CACO3)		44.00	56.00			8.00	18.79	31.00
Diss.Cu (mg/1)		<10	<10			0.00	2.25	6.00
Diss.Cd (mg/1)		<10	<10					
Diss.Cr.(mg/1)		<10	<10					
Diss.Pb (mg/1)		<50	<50			0 0 0	7.96	19.00
Diss.Ni (mg/1)						0.00	12.42	130.00
Diss.Zn (mg/1)		<10	<10			0.00	12.42	130.00
Chloride as Cl		21.3	21.3			1.60	3.10	5.80
Soluble iron as Fe (mg)/1)		240	230					
Soluble Manganese as Mn		490	500					

Estimated
< Less than
> Greater than
* Based on data collected from 10/70 through 9/79
**Too much sediment

Data compiled by Anne Haines
Washington Department of Ecology

APPENDIX III
PLATE THEORY LINKS ST. HELENS, RED SEA, ANTARCTICA

By DOUGLAS GANTENBEIN

Though they are thousands of miles apart, Mount St. Helens, the Red Sea and coal deposits in Antarctica all have a great deal in common.

They all owe their origins — and in the case of St. Helens, present activity — to "plate tectonics," the geophysical law that daily changes the shape of our earth.

Plate tectonics emerged as the leading theory behind the formation of the continents during the 1960s, when a wealth of new information gave sudden meaning to long-time puzzles. Put simply, it says that the earth consists of large, rigid "plates" floating over the semi-molten mantle of the earth.

Plate tectonics accounts for the presence of tropical plant and amphibian fossils in icy Antarctica.

It also accounts for the jigsawlike appearance of parts of the earth. Anyone with a world map can see that South America and Africa and the land masses of Saudi Arabia and northeast Africa fit together too closely for mere coincidence.

The notion that continents were moving is not new, said Peter Misch, a University of Washington geologist. An Austrian geologist had theorized early this century that the Alps were the byproduct of a collision between Africa and Europe.

But this created a puzzle. If parts of the earth were colliding — with one likely sliding beneath another — from where did the material to replace it with come?

The answer came from marine geophysicists early in the 1960s with the discovery of sea-floor spreading.

This concept says that the mid-ocean ridges found in all of the major oceans of the world lie over enormous pools of molten material. As this hot material rises, it pushes earlier deposits to either side, widening the sea floor.

Hints that this might be occurring emerged around 1962, said a University of Oregon geology professor, Dr. Alexander McBirney.

McBirney said it was then the startling discovery was made about there being virtually no "old ocean crust — it all was millions of years younger than the surrounding continents.

It had been assumed the sea floor and the dry land masses were about the same age, and the two were created when a younger, hotter earth split up into lighter and heavier geologic masses.

At first controversial, the sea-floor spreading theory gained credence when phenomena called magnetic anomalies were discovered on either side of the midocean rifts.

As the rock material issues on to the sea floor, it adopts the magnetic polarity prevalent at the time. But for unknown reasons, the earth's magnetic field shifts at intervals of from 50,000 to 20 million years.

As the field shifts, the new rock assumes the polarity that then exists. The result is a series of magnetic bands of differing polarity that are symmetrical on each side of the midocean rift.

The mechanics of sea floor spreading began far before the earliest life on the planet — possibly as long as 3½ billion years ago said McBirney.

At that time, the earth's continents were part of a massive super-continent, commonly referred to as "Gondwanaland."

As the ocean floors began to expand, Gondwanaland was split up. South and North America broke free from Europe and Africa and moved across what is now the Atlantic Ocean. Antarctica moved southward — in the case of Antarctica from a tropical to a polar environment.

Sea floor spreading continues today between six identifiable major plates. It varies from one to eight centimetres (about 2 inches) annually.

At that rate, it would take about 200 million years to create the Pacific Ocean and about 150 million years to form the Atlantic.

In the Pacific area, sea floor spreading takes place along a line extending southward from the so-called Juan de Fuca ridge, located about 200 miles off the Oregon coast.

Interrupted in southern California — where the Pacific and American plates are moving laterally, not separating — the Pacific rift begins again just east of Mexico and conintues in an enormous arc across the Pacific, under Australia and into the Indian Ocean.

An obvious question is this: If the sea floors are expanding at the lightning-like (geologically speaking) rate of almost 2 inches a year, why does not the earth run out of room for all this new material?

The answer is the key to such events as the St. Helens eruption, said Peter Misch.

As the heavy sea floor material moves along the surface in a layer some 10 kilometres thick, it eventually collides with the thicker (50-70 kilometres), lighter continental plates. "Floating" as they are on the heavy basalt, the continental blocks are able to override the approaching sea floor crust, forcing it to bend and move beneath the continents.

The area where the sea floor crust plunges beneath the continents is called the subductive zone, Misch said. Around the Pacific Ocean, a subduction zone extends from the North American coast northward through the Aleutians and down through Japan.

It is this subduction zone that is responsible for the storied "Ring of Fire" around the Pacific. But although subduction zones and vulcanism clearly are associated, many of the details concerning the exact origin of volcanoes are not clear.

As the sinking crust moves deeper in the subduction zone, temperatures increase. However, pressure increases as well, raising the melting point of the rock. It is not clear Mirsch said, that this hot, nosediving sea-floor crust is the material that eventually is tossed out of volcanoes. Samples of lava from volcanoes simply do not connect the lava to the offshore sea floor.

What may be happening instead, he explained, is that water carried down with the sea floor material becomes superheated and rises. As it comes in contact with other rock materials, it lowers the melting point of that rock.

This newly melted rock, then, might be what becomes the magma that forms volcanoes.

The precise mechanics of magma formation also are unclear. As Misch said, "We're not able to climb down a hundred kilometers and look at the rocks."

But there is evidence of an "asthenosphere" of semi-molten rock that could be the birthplace of magma. Alexander McBirney said this zone corresponds with the intersection of the sinking sea plates and the zone of vulcanism in the Pacific Northwest.

The line of volcanoes in Oregon, Washington and northern California obviously relates to some point where the submerging sea crust becomes hot enough to either move up itself or force rock above it to melt and rise. As McBirney said, "it's a matter of faith" that subduction and vulcanism are related.

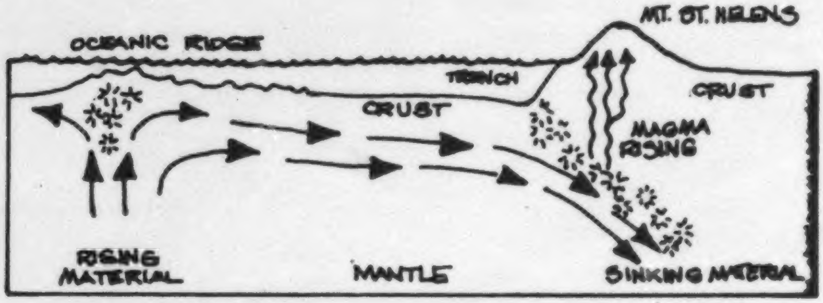
Even the manner in which magma is able to collect into amounts large enough to force its way to the surface is not entirely known.

"That's the $64 question," Misch said.

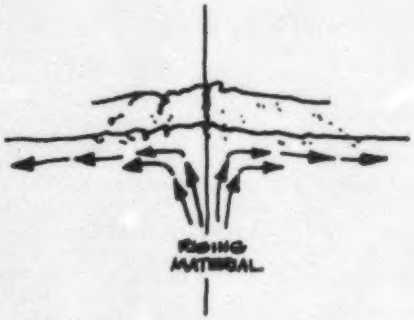
Apparently, the molten material collects and simply rises through the heavier, denser layers of the earth's mantle until it reaches cracks in the less plastic continental crust, from where it seeps to the earth's surface.

In most cases, the eventual result is a volcano. Sometimes, however, an enormous "bubble" of magma will come near the earth's surface but will not break through. Such magma domes, called batholiths, underlie parts of the North Cascade range in Washington.

THE COLUMBIAN, March 30, 1980



The Pacific Ocean, as it might look in profile as hot material rises through an oceanic ridge, or rift, then moves toward North America. As it sinks beneath the continent, the ocean crust is heated and apparently is at least indirectly related to volcanoes above it.



Cross-section of a midocean rift shows how rising material moves away from the rift. Dark and light bands are "magnetic anomalies."

APPENDIX IV

MOUNT ST. HELENS, MAY 18-19, 1980 — A SCENARIO

By MICHAEL A. KOROSEC

On Sunday morning, May 18, 1980, the climactic eruption of Mount St. Helens began. From U.S. Geological Survey news releases, media coverage, and eyewitness accounts, an attempt will be made to build a scenario of the events that took place in the vicinity of the volcano that day and the next. Relatively little information is available at the time, considering the magnitude of the explosive eruption and its devastation. As more facts and observations are collected and become available, it is likely that portions of this scenario will need to be changed.

At about 8:32 a.m. Sunday morning, a Richter magnitude 4.9 earthquake was recorded. Prior to the earthquake, the only visible activity on the mountain was very minor venting of steam from a fumarole at the bottom of the crater and from the small vent on the southeast rim of the crater. The earthquake triggered the collapse of ice blocks into the crater from glaciers on the south side. A few seconds later, a large portion of the north flank of the volcano began heaving and rippling, and slipped downslope towards the valley of the North Fork of the Toutle River along a fairly flat, steep detachment plane.

Many steam vents opened at the top of this detachment plane almost immediately, and either dust or steam was pushed out in front of the slide. As the downward movement of the slide exposed a deep portion of the slide plane, perhaps 1,000 feet in elevation below the top of the detachment surface, a cloud of dark-colored ash arose nearly vertically at first, but quickly spread laterally to the north. As the landslide continued to move downslope, the ash cloud grew very quickly as it was blasted about 25 to 40 degrees from vertical off toward the north. At the same time, a lateral blast was directed nearly due north through the upper portion of the slide block. Very shortly after, the summit crater erupted with a vertical blast of steam and ash. The vertical flank eruptive cloud was initially darker than the developing upper crater cloud, and the lateral blast which spread outward much more quickly than the others was the lightest in color.

The leading edge of the lateral blast raced ahead of the landslide, reaching the valley floor and traveling up and over the north valley walls. As it reached trees, the blast stripped their branches and needles. Stumps were left standing but again were partially buried by heavy ash fall. In the fringe areas, pine needles were either stripped from standing trees or singed orange in a zone about 100 to 300 meters beyond the fallen trees. The ash cover ranged from several feet to several inches out from the crater. A rapid transition from four inches to less than an inch over a distance of about ¼ mile occurred just beyond the zone of fallen trees on the far northwest corner of the devastated area.

Temperatures within the zone of devastation must have been quite high, estimated to have been between 200 and 300 degrees Celsius. Plastic on a blown-over truck camper 13 miles north-northeast of the volcano in the Ryan Lake area was melted. Similar occurrences have been reported for vehicles near Spud and Elk Mountain northwest of the volcano. Fishermen along the Green River in section 3 were burned badly, surviving only because they jumped into the river when it happened. The burns occurred as they came up for air and after they left the water. The heat evidently came upon them in a series of waves over a period of about 10 to 15 minutes.

After the lateral blast lost its hurricane force and high temperatures, the ash cloud slowed considerably, but continued to move to the northwest and northeast, reaching the town of Silverlake about 1.5 hours after the eruption. The cloud moved along the surface topography at an altitude of less than 1,000 feet, traveling about 20 to 30 miles per hour. It was this cloud which deposited significant amounts of the ash in the Mossyrock and Riffe Lake area, and much of the Morton ash.

The nuee ardente or ash cloud which rolled down the south side of the volcano was much smaller than the north side activity, descending not far beyond the slope break. No obvious destruction resulted from this nuee, though it probably did deposit at least a thin layer of hot ash on the south flank.

At the crater, dark ash clouds were shooting upward very rapidly, reaching elevations of 50 to 60 thousand feet within several minutes of the initial eruption. Rock fragments and pumice were carried upward along with the ash, raining out in a large area to the north and east, extending at least to the Blue Lake and Horseshoe Lake area, 25 to 30 miles away. The ash, of course, was carried well beyond this point.

Pyroclastic flows periodically poured out of the crater and down the north flank into the valley below. These flows probably occurred throughout the day, with a few reported to have occurred the next day. The early pyroclastic flows, along with the hot ash and debris began melting the snow and ice that remained on the flanks of the mountain and the broken glacial ice blocks within the valley. This water, along with ground water, possibly torrential rains from the eruption cloud, and water displaced from Spirit Lake, mixed with the ash and debris in the valley, creating small to very large mudflows which combined and began moving down the Toutle River valley very shortly after the eruption began. This process continued, to varying degrees, throughout the day. At some point, a large mudflow developed in the upper reaches of the South Fork of the Toutle River valley from the Toutle and Talus Glaciers. In addition, waters from the vicinity of Shoestring Glacier mixed with ash and debris, creating a mudflow which moved down the southeast flank and out the Pine Creek drainage, reaching the Swift Reservoir. Hot ash and pyroclastic flows which poured down the northeast flank and across the Plains of Abraham, melted the ice fields between the Nelson Glacier and Dogs Head. This created a very large mudflow which moved down the western drainages of Smith Creek, continuing southeast along the main course of Smith Creek into the Muddy River and reaching the Swift Reservoir. These two east and southeast mudflows raised the level of Swift Reservoir by two feet.

During the course of the day, a large volume of material was removed from the south wall and the area between the central and lateral vents. At times, two distinct plumes could be seen rising from the crater, one directly over the central vent, the other centered nearly a mile due north, just south of the pre-eruption location of Goat Rocks. A large portion of this material may have been removed during the initial blast. There is no way of knowing how many individual pyroclastic flows and nuees ardentes descended the slopes of Mount St. Helens during the day and night. Some flows are reported to have traveled at speeds in excess of 70 miles per hour.

The vertical ash eruption had maintained levels of 50,000 to 60,000 feet for several hours after the initial eruption, but decreased by early afternoon to levels at times under 40,000 feet. By 4:30 p.m., the ash cloud had built back up to its highest level, about 63,000 feet, lasting for about an hour. This large vertical blast may have been accompanied by a lateral event on the north side, such as a large nuee ardente, because another low altitude ground-hugging ash cloud passed just east of Silver lake, at about 6:00 p.m., moving north at about 20 to 30 miles per hour. By evening, the height of the vertical eruption was only 15,000 feet, but occasionally reached 20,000 feet during short blasts. By Monday, eruptions consisted of ash erupting to only a couple of thousand feet above the crater.

Seismic activity consisted of an almost continuous series of low to moderate strength events during the initial phase of the eruption. Harmonic tremors were recorded throughout the day, starting out at shallow depths of 2 to 3 km and getting progressively deeper to about 10 km by day's end. Just before noon, seismic activity increased. This seems to correspond with a color change for the ash, from dark to light. The activity climaxed between 3:00 and 5:00 p.m., roughly corresponding to the second large vertical ash eruptions. After this period, however, activity dropped off considerably.

By Monday, with the eruptive activity on Mount St. Helens beginning to slacken, the topographic changes to the area around the volcano could be assessed. The once symmetrical 9,671-foot peak had been transformed into a U-shaped basic nearly 2 miles long from north to south and about 1 mile wide east to west. The rim reached a reported maximum elevation of about 8,400 feet, but portions of the rim were several hundred feet lower. The north flank opening to the crater is at about the 4,400-foot elevation. The Sugar Bowl and Dogs Head domes were preserved on the northeast side. Most of the glaciers are gone, but a few remained, at least in part, under a cover of ash. They possibly include Swift, Dryer, Talus, Toutle, Ape and Shoestring glaciers.

Within the crater, steam issued from numerous vents and fumeroles, concentrated on the south side over the central vent, with a few in the area of the exposed core of the Goat Rocks dome in the northern part of the crater basin. The crater bottom is about 300 feet below the north rim, and several thousand feet below the south rim.

The Swift Reservoir south of the volcano had its water level raised by about 2 feet, representing an influx of 13,000 acre-feet of debris from Pine Creek, Smith Creek and Muddy River.

The North Fork Valley of the Toutle River had been filled to a relatively flat surface, about 200 feet above the old valley floor. The material was a combination of ash flow, landslide material, large blocks explosively ejected from the volcano, and pyroclastic material. This valley filling extended down the valley to about Camp Baker and up some of the drainages such as Coldwater Canyon. Spirit Lake, which had been 185 feet deep, had its shoreline and drainage outlet raised by about 200 feet, and its shoreline extended about ¾ of a mile to the south. The depth had been reduced to about 80 to 100 feet, requiring a filling of 250 to 300 feet of debris.

Secondary activity within the valley resulting from cool waters contacting hot pyroclastic debris resulted in numerous steam eruptions and continuous fumarolic activity. A few large steam vents and many hundred fumaroles were still active two weeks after the eruption, and may continue to be active for years and possibly decades. Other features occurring in the debris-filled valley include kettle holes, where small to vary large blocks of ice melted out, leaving depressions measuring up to 50 feet in diameter; explosion craters, where buried ice and water were converted to steam in contact with hot pyroclastic debris and exploded upward through the sediment cover; "badland" and "scabland" topography, where water had eroded channels, sometimes 20 to 30 feet deep, and interconnected by a maze of smaller channels; small ripple and dune features, where water and(or) wind had piled or scoured ash; and large blocks of hydrothermally altered rock from the volcano's flanks, some over 50 feet high, looking like islands in a sea of mud and ash.

The May 18, 1980 eruption of Mount St. Helens was only one day in the history of a mountain that is thousands of years old, but that one day has left an important impact on the volcano and its surrounding area, and a lasting impression on all those who were a part of it.

WASHINGTON DEPARTMENT OF NATURAL RESOURCES
July, 1980

APPENDIX V

FACT SHEET

Gifford Pinchot National Forest
Pacific Northwest Region
500 West 12th Street
Vancouver, Wash. 98660
Mount St. Helens Geological Area
Volcano Information

FACT SHEET — July 10, 1980

BACKGROUND INfORMATION:

Location: 50 miles from Portland, Ore., in the Gifford Pinchot National Forest in the state of Washington.

Height: Summit elevation now approximately 8,400 feet. (Original height before eruption — 9,677 feet.)

Last Eruption: Last eruption from 1830s until 1857. Dormant for 123 years until March 27, 1980.

Other active volcanoes: First volcanic eruption in continental 48 states since Mt. Lassen in California last erupted in 1921.

CURRENT ACTIVITY:

Eruptions: From March 27 through May 17, 1980, consisted of steam and ash, with some small mud flows. On May 18, a violent explosion blasted away the northern portion of Mount St. Helens. The blast, accompanied by hot gasses, pumice, and ash devastated more than 150 square miles in a north and northwest direction from the mountain, with all trees and vegetation laid flat or killed. The largest ash cloud reached 63,000 feet and was tracked around the world. Ash fallout was heavy and crippled cities — Yakima, Washington, 85 miles away received 4 inches; Spokane, Washington, 255 miles — 1 inch; Pullman, Washington and Moscow Idaho, 260 miles — 2 inches.

On May 25 and June 12, two smaller eruptions, accompanied by some pyroclastic flows, left ⅛ — ½ inch of ash on Portland, Oregon and Vancouver, Washington, and southwestern Washington.

A dome of crusty volcanic magma has developed within the new crater. Currently the venting is mostly steam with occasional ash.

Fatalities: 28

Missing People: 36

Crater: May 18 eruption left crater approximately 1 mile wide and 2 miles long. An estimated one cubic mile of rock or 12 percent of the mountain was blasted away in the eruption. Elevation of mountain was reduced by 1,270 feet from 9,677 to approximately 8,400 feet. Landslides occur in the crater periodically.

Earthquakes: From March 22 through May 15 over 2,785 quakes of magnitude 3.0 or greater, of which 371 were over 4.0. Strongest to date: 5.1 on May 18. Earthquakes have subsided considerably since May 19, but vary with the degree of eruptive activity.

Floods: Mud flows and flooding caused extensive damage downstream from area.

The level of Spirit Lake was raised 150 feet by the mud flows, changing the shoreline. It has receded somewhat now.

Resource Losses:(Preliminary estimates) Twenty thousand acres of National Forest were devastated and another 200,000 acres heavily damaged or covered by 4 inches or more of ash. Resources destroyed: 1.6 billion board feet of timber; 100 miles of streams; 2,300 big game animals; 27 recreation sites; 63 miles of road; 12 bridges; 97 miles of trails; and 15 Forest Service buildings.

Total value lost: $134,987,000.

Potential Hazards: 1. Probable ash and steam eruptions.

2. Rapid moving flows of mud (melting snow and ice mixed with ash).

3. "Pyroclastic flows." These are masses of fiery gases and lighweight volcanic particles that skim like an avalanche along and above the ground at speeds of up to 100 miles per hour.

4. Ash fall carried by prevailing winds as a result of a major eruption.

5. Flooding.

CHRONOLOGY OF EVENTS:

- March 20: First earthquake reported. Earthquakes continued to build in number and magnitude.
- March 27: First eruption of steam and ash. This continued until April 18 when it stopped.
- April 18; 35,000 acres of Gifford Pinchot National Forest designated as Mount St. Helens Geological Area.
- May 7: Eruptions of steam and ash began again. Continued until May 14, when they stopped again.
- May 18: Big landslide and explosive eruption, accompanied by mud flows, large pyroclastic flows, flooding, and extensive ash deposit.
- May 25: Second substantial ash eruption with some pyroclastic flows.
- June 12: Third substantial ash eruption accompanied by pyroclastic flows.
- July 22: Fourth eruption, with less ash.

APPENDIX VI

EARTHQUAKE AND OTHER DATA FROM MT. ST. HELENS

DATE	A Average Number of earthquakes/Hr.	B Number of earthquakes greater than 4.0	C Largest earthquake in the 3-day period	OTHER INFORMATION
March 20,21,22	O+		4.1	
23,24,25	½		4.4	
26,27,28	5		4.9	First ash and steam eruptions
29,30,31	3½		4.6	First harmonic tremor
April 1,2,3	2½	2	4.9	Ash and steam to 20,000 feet
4,5,6	3	4	4.5	
7,8,9	2	4	4.7	Harmonic tremors occured in this 9-day period
10,11,12	1½	4	4.9	
13,14,15	1½	6	4.7	
16,17,18	1½	6	4.6	
19,20,21	2	7	4.8	No harmonic tremors
22,23,24	1½	9	4.6	Bulge detected
25,26,27	1	7	4.7	
28,29,30	1	7	4.7	No eruptive activities
May 1,2,3	1	6	4.7	
4,5,6	1	7	4.8	
7,8,9	1	9	5.0	Steam and ash eruption
				Harmonic tremor
10,11,12	½	10	5.0	No harmonic tremors
13,14,15	1	8	4.8	Decrease in eruptions
16,17	1	3	4.4	Major eruption
18			5.1	

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